MOTT MACDONALD

BERGEN COUNTY UTILITIES AUTHORITY

(NJPDES # NJ0020028)

Sewer System Characterization Report

June 27, 2018

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Certifications

Title: **BCUA Sewer System Characterization Report**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Preparer: 6/18/18

John S. Rolak, Jr. P.E. #29108 **Date**

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June 2018

BCUA Sewer System Characterization Report

Submitted on behalf of the following participating Permittee by Bergen County Utilities Authority on behalf of the BCUA CSO Group

NJPDES Number NJ0020028 (Bergen County Utilities Authority)

Approval of Report:

Permittee: _____ 6/12/18

Robert E. Laux — Date

Executive Director, Bergen County Utilities Authority

NJPDES Certification:

"Without prejudice to any objections timely made to permit conditions, I certify under penalty of law that this document and all attachments were prepared as part of a cooperation performed by members of the BCUA CSO group effort in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information. Based on my inquiry of the person or persons who developed this report, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Permittee: _____ 6/12/18

Robert E. Laux — Date

Executive Director, Bergen County Utilities Authority

June 2018

BCUA Sewer System Characterization Report

Submitted on behalf of the following participating Permittee by Bergen County Utilities Authority on behalf of the BCUA CSO Group

NJPDES Number NJ0034517 (Borough of Fort Lee)

Approval of Report:

Permittee: _____ 6/13/18
Alfred R. Restaino, Borough Administrator Date

NJPDES Certification:

"Without prejudice to any objections timely made to permit conditions, I certify under penalty of law that this document and all attachments were prepared as part of a cooperation performed by members of the BCUA CSO group effort in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information. Based on my inquiry of the person or persons who reviewed this report, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Permittee: _____ 6/13/18
Alfred R. Restaino, Borough Administrator Date

June 2018

BCUA Sewer System Characterization Report

Submitted on behalf of the following participating Permittee by Bergen County Utilities Authority on behalf of the BCUA CSO Group

NJPDES Number NJ0108766 (City of Hackensack)

Approval of Report:

Permittee: _____ 6/18/18
Wayne Vriesema — Date
Project Manager, City of Hackensack

NJPDES Certification:

"Without prejudice to any objections timely made to permit conditions, I certify under penalty of law that this document and all attachments were prepared as part of a cooperation performed by members of the BCUA CSO group effort in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information. Based on my inquiry of the person or persons who reviewed this report, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Permittee: _____ 6/18/18
Wayne Vriesema — Date
Project Manager, City of Hackensack

BCUA Sewer System Characterization Report

Submitted on behalf of the following participating Permittee by Bergen County Utilities Authority on behalf of the BCUA CSO Group

NJPDES Number NJ0109118 (Village of Ridgefield Park)

Approval of Report:

Permittee: _____ 6/18/18

Alan O'Grady — Date
Superintendent, Village of Ridgefield Park

NJPDES Certification:

"Without prejudice to any objections timely made to permit conditions, I certify under penalty of law that this document and all attachments were prepared as part of a cooperation performed by members of the BCUA CSO group effort in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information. Based on my inquiry of the person or persons who reviewed this report, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information."

Permittee: _____ 6/18/18

Alan O'Grady — Date
Superintendent, Village of Ridgefield Park

Executive Summary

The Bergen County Utilities Authority (BCUA) currently owns and operates the Water Pollution Control Facility (WPCF) located in Little Ferry and provides wastewater transportation and treatment services for forty-seven (47) municipalities, serving a population of about 565,000 people. The BCUA services municipalities that are primarily located in the Hackensack River and Overpeck Creek drainage areas and provides wastewater treatment and transportation services to three (3) municipalities with combined sewer systems: the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park. The BCUA Service Area extends approximately five (5) miles south and fifteen (15) miles north of the Little Ferry WPCF and is bounded by the Hudson River on the east, by New York State to the north, by the remainder of Bergen County to the west, and by Hudson County to the south. The Authority's service district covers approximately 135 square miles and is located primarily in the Hackensack River drainage basin.

The BCUA owns and operates a Trunk Sewer System comprised of trunk sewers and intercepting sewers (branch sewers that are tributary to the trunk sewer) that convey wastewater from the tributary municipalities to the WPCF. The trunk sewer system was constructed in phases/sections. The Overpeck Trunk Sewer, completed in 1951, was the first to be constructed and extends from Little Ferry to Tenafly. The Main Trunk, or Hackensack Valley Trunk Sewer was completed in 1964 and extended wastewater service to 16 municipalities along the Hackensack River and extended service from Little Ferry to Westwood. In addition, the Southwest Trunk Sewer extended service from Little Ferry to Hasbrouck Heights in 1972. The third Trunk Sewer was completed in 1972, and two major subsystems were completed in 1976 extending service to the Pascack Valley and Northern Valley areas of Bergen County. The Overpeck Creek Relief Trunk Sewer was completed in 2011.

The New Jersey Department of Environmental Protection issued New Jersey Pollutant Discharge Elimination Permits (NJPDES) to all municipalities/authorities that own or operate combined sewer systems and authorities that provide wastewater transport and/or treatment services to municipalities with combined sewer systems. The BCUA owns and operates the trunk/intercepting sewer systems that transport flows to the WPCF, including wastewater flows from combined sewer systems. The collection and conveyance of wastewater (both dry and wet weather) from municipal combined sewer systems into the BCUA Trunk Sewer, including the CSO discharge pipes, are owned and operated by the individual municipalities. These facilities are permitted under Individual NJPDES Permits provided to the BCUA and each combined sewer municipality with an effective date of July 1, 2015 as follows:

- Bergen County Utilities Authority (BCUA) – NJPDES Permit No. 0020028
- Borough of Fort Lee – NJPDES Permit No. 0034517
- City of Hackensack – NJPDES Permit No. 0108766
- Village of Ridgefield Park – NJPDES Permit No. 0109118

These permits require that the permittees prepare and submit a Sewer System Characterization Report (Report) and ultimately a CSO Long Term Control Plan (LTCP). The permit provided the option for these to be undertaken on a regional basis for all hydraulically connected municipalities to BCUA. The BCUA, Fort Lee, Hackensack, and Ridgefield Park agreed to undertake a Regional approach to the Characterization Study and CSO LTCP. Work being undertaken together is being completed by the BCUA CSO Group, which is made up of all four individual permittees within the District.

The Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park had all completed and reported upon their Sewer System Characterization Studies under the General CSO NJPDES Permit in April 2007, however this was never a permit requirement of the BCUA since it did not own nor operate any CSO Outfalls. The 2015 Individual NJPDES Permit required that municipalities with CSO Outfalls needed to update their previous work and reports to the extent necessary, but also required that authorities such as BCUA undertake a Sewer System Characterization Study of their transport facilities so that transport and treatment capacity of the Regional facilities could be considered in the development of the CSO LTCP.

While the members of the BCUA CSO Group have agreed to complete a Regional Sewer System Characterization Study and CSO LTCP most of the work will be completed separately and then coordinated and integrated through group meetings into a regional submission through the BCUA. Three different consultants were engaged in the development of Regional Report. The Borough of Fort Lee retained HDR to complete its individual Report, the City of Hackensack retained Arcadis to complete its individual Report, while the Village of Ridgefield Park and BCUA both retained Mott MacDonald to complete their Reports. Both HDR and Mott MacDonald completed their sewer system modeling using the InfoWorks ICM model, while Arcadis utilized PCSWMM. InfoWorks does have the ability to import data from other models and thus the PCSWMM model was integrated into the BCUA InfoWorks model and then tested using rainfall data from Hackensack to verify that the converted model was providing data consistent with the original PCSWMM Model. Good agreement was obtained between the converted and original model data.

The BCUA collection system model was built and simulated using the InfoWorks ICM collection system modeling software. The BCUA collection system model was built using a combination of independently built and calibrated models for the combined sewer communities (Hackensack and Ridgefield Park) together with modeling to represent the BCUA trunk sewers, plant infrastructure, and contributions to that infrastructure from the separate sewer communities. The Fort Lee InfoWorks model was not available at the time of model development and will be integrated into the model in the future. A subset of the permanent flow meters maintained by BCUA for billing purposes, including two for Fort Lee, along with the temporary flow meters described in Section 3 that were installed along the BCUA trunk system were used for model development and calibration/validation.

While the BCUA had undertaken certain hydraulic studies in segments of their transport system it did not have a calibrated and verified computer model of their entire system. Mott MacDonald worked with BCUA to develop a monitoring and modeling quality assurance/quality control project plan (QAPP), which was submitted and subsequently approved by the NJDEP. The QAPP outlined real time hydraulic monitoring (flow and or depth) at ten different locations spread along the various BCUA Trunk Sewers encompassing the CSO municipalities to develop data that could be utilized in the calibration and verification of the model. Flow monitoring was conducted for a period of approximately six months. Additional detailed information on the monitoring locations is provided in the report.

In addition to the temporary monitoring as noted above, the BCUA maintains permanent meters on all wastewater discharges into the BCUA Trunk Sewer System. These meters are maintained for billing purposes but were used as input in the development of the BCUA model. The BCUA owns and operates over 150 metering sites, however a review of average daily flows showed that forty-five of the meters measure 85% of the wastewater flows into the system. Long term data from the forty-five largest permanent meters were used with SSOAP Toolbox to evaluate and simulate RDII (Rainfall Induced Infiltration and Inflow) for assessments of flows for long term model simulations. Overall the forty-five

meters range in average daily flow from a low of 0.40mgd/day to about 4.0 mgd/day. BCUA owned and operated flow meters are calibrated quarterly to assure reliable billing data and thus were ideal for long term data analyses.

While the BCUA system does include the three combined sewer communities, it also services forty-four separate sewered areas that needed to be included in the BCUA InfoWorks trunk sewer model. Model calibration involves both dry and wet weather flows even in separate sanitary sewer areas. Dry weather base sanitary flow (BSF) diurnal pattern were assigned to all sub-catchments within a meter basin area with BSF flows allocated based on population fraction. Similarly, ground water infiltration (GWI) flows were allocated based on pipe inch-mile fraction within the metered basin. Monthly varying GWI factors were assigned in metered basins where highly variable GWI responses were identified. Extended dry weather flow (DWF) periods were identified during both the Spring and Fall of the 2017 flow monitoring period to use for DWF calibration. Comparing the model's DWF results to an extended dry weather period in the flow monitoring period is a more robust comparison than simply comparing selected DWF days pulled from the flow monitoring record. Two continuous DWF weeks were identified in April and September from the 2017 data. Each of these weeks consisted of at least a six-day continuous dry weather period that also include different seasons. Overall the simulated vs measured peak flows, flow volumes, and sewer depths ran from -10.7% to +8.3% in September 2017 indicated good agreement between measured and modeled data.

Following completion of the dry weather flow calibration, wet weather calibration of separate sanitary sewered areas was initiated. An autocalibration Sensitivity Based Radio Tuning Calibration (SRTC) tool within PCSWMM was applied. Very good wet weather calibrations were obtained and then transferred to the InfoWorks model. For the reporting of individual event statistics, a total of 15 storm events were identified (10 for calibration and 5 for validation). The overall goal was to get storms that represented a wide variety of durations, peak intensities, total rainfalls and that were distributed through different seasons. Overall WWF calibration and validation was completed with variable success with some locations calibrating successfully and others not fully meeting the calibration criteria as established. In general, it was difficult to simulate the distribution of wastewater flows between the Overpeck Trunk and Relief Sewers due to changing hydraulics in the junction chambers with changes in flow. Nevertheless, it was found that measured and simulated flows for total wastewater flows downstream of each junction chamber was generally within WaPUG criteria. Overall, it was noted that very good comparisons were obtained for both peak flows and volumes during wet weather periods.

In addition to characterization of the combined sewer systems, permittees also need to characterize the receiving waters accepting CSO discharges. This was accomplished jointly with the NJ CSO Group organized by the Passaic Valley Sewerage Commission (PVSC). PVSC retained Greeley and Hansen/CDM Smith on behalf of the Group to undertake receiving water monitoring and modeling within the Gateway Region, which included, but was not limited to the Passaic River, the Hackensack River, Newark Bay, the Kill Van Kull, the Arthur Kill, the Raritan River and Raritan Bay, and the Hudson River. Greeley and Hansen/CDM Smith has prepared a Baseline Compliance Monitoring Report providing the results of the receiving waters in the region. Information on the receiving waters associated with CSO discharges in the BCUA District is provided in the Section 1 of the Report. In general, consistent compliance with water quality standards is not being obtained, however this is also true in regions serviced by separate sanitary and storm sewers and not impacted by CSO discharges. Accordingly, additional evaluations will need to be completed to develop a better understanding of the water quality impacts from CSO discharges.

1 Introduction

The Bergen County Sewage Authority (now the Bergen County Utilities Authority, or BCUA) undertook the construction of a trunk sewer and sewage treatment plant in the late 1940s to relieve the pollution in Overpeck Creek. The plant, which went into operation in 1951, provided secondary treatment for a design flow of 20mgd to serve ten municipalities and industries along the Overpeck Valley (Cliffside Park, Englewood, Fairview, Fort Lee, Leonia, Palisades Park, Ridgefield, Ridgefield Park, Teaneck, and Tenafly) several of which had combined sewer systems. In the early 1960's, the Sewage Treatment Plant service was extended to sixteen (16) additional municipalities including Hackensack City, which also has a combined sewer system. Plant capacity was increased periodically over the years to extend service to other municipalities in eastern Bergen County to its present capacity of 109mgd. In 2014 the average daily flow treated averaged 77.3 mgd and a peak wet weather flow of 250mgd recorded on April 30, 2017. The last municipality to be added to the District was Wood-Ridge in 1992.

The BCUA currently owns and operates the Water Pollution Control Facility (WPCF) located in Little Ferry and provides wastewater transportation and treatment services for forty-seven (47) municipalities, serving a population of about 565,000 people. The BCUA services municipalities are primarily located in the Hackensack River and Overpeck Creek drainage areas. The areas serviced by the BCUA are primarily residential with isolated sections that service industrial and commercial facilities. It is estimated that approximately 8% – 10% of the dry weather flow to the BCUA Water Pollution Control Facility (WPCF) is contributed by these industrial and commercial facilities.

The BCUA provides wastewater treatment and transportation services for forty-four (44) municipalities with separate sewer systems, and three (3) municipalities with combined sewer systems: the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park. While the BCUA owns and operates the trunk / intercepting sewer systems (trunk sewers) that transport flows to the WPCF it does not own or operate any of local collector sewers, which are owned and operated by each individual municipality. The BCUA service area covers approximately 135 square miles, primarily located in the Hackensack River drainage basin. This service area is bounded by the Hudson River on the east, by New York State to the north, by the remainder of Bergen County to the west, and by Hudson County to the south.

The BCUA owns and operates a trunk sewer system that conveys wastewater from the tributary municipalities to the WPCF. The trunk sewer system was constructed in phases/sections as service was extended to other municipalities. The Overpeck Trunk Sewer completed in 1951 was the first to be constructed and extends from Little Ferry to Tenafly. The Main Trunk, or Hackensack Valley Trunk Sewer was completed in 1964 and extended wastewater service to 16 municipalities along the Hackensack River and extended service from Little Ferry to Westwood. In addition, the Southwest Trunk Sewer extended service from Little Ferry to Hasbrouck Heights in 1972. The third Trunk Sewer was completed in 1972, and two major subsystems were completed in 1976 extending service to the Pascack Valley and Northern Valley areas of Bergen County. The Overpeck Creek Relief Trunk Sewer was completed in 2011.The extent of the BCUA Service District and the combined sewer areas within the study area are illustrated in Figure 1.

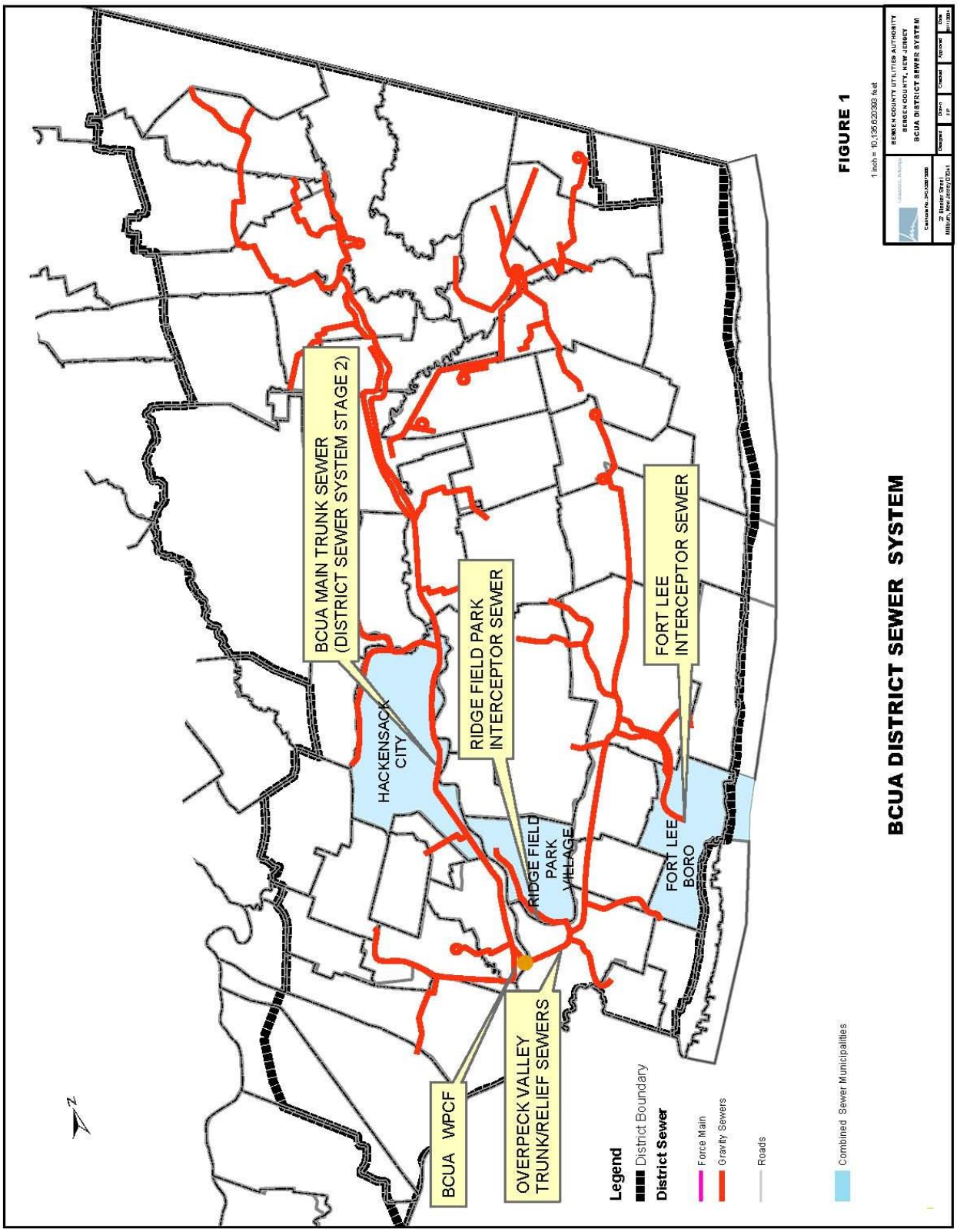

Figure 1 – BCUA District Trunk Sewers

The collection and conveyance of wastewater (both dry and wet weather) from municipal combined sewer systems into the BCUA Trunk Sewer, including the CSO discharge pipes, are owned and operated by the individual municipalities. In addition, all CSO Control Facilities in the City of Hackensack and the Borough of Fort Lee, and four of the seven CSO Control Facilities within the Village of Ridgefield Park are owned and operated by their respective municipality. BCUA owns and operates three CSO Control Facilities within the Village of Ridgefield Park. These CSO facilities are permitted under Individual New Jersey Pollutant Discharge Elimination Permits (NJPDES) provided to the BCUA and each combined sewer municipality with an effective date of July 1, 2015 as follows:

- Bergen County Utilities Authority (BCUA) – NJPDES Permit No. 0020028
- Borough of Fort Lee – NJPDES Permit No. 0034517
- City of Hackensack – NJPDES Permit No. 0108766
- Village of Ridgefield Park – NJPDES Permit No. 0109118

These permits require that the permittees prepare and submit a System Characterization Work Plan/Report and ultimately a regional CSO Long Term Control Plan for all hydraulically connected municipalities to BCUA. The information collected will be used to evaluate all CSO control alternatives as per Part IV – CSM, G.4 of the NJPDES permit.

The BCUA's Trunk Sewer System is depicted in Figure 1 with the three tributary combined sewer municipalities highlighted in blue located at the downstream end of the system. The combined sewer municipalities are serviced by either the Overpeck Valley Trunk Sewer/Overpeck Valley Relief Sewer (Fort Lee Borough and the Village of Ridgefield Park) or the BCUA Main Trunk Sewer constructed as the District Sewer System Stage 2 (Hackensack), which services municipalities along the Hackensack River and extends from the Little Ferry WPCF north toward New York State. Accordingly, the BCUA has studied its trunk sewer system to characterize the wet weather components of its transport and treatment facilities. This study in conjunction with characterization studies performed with the other members of the BCUA Group will be used to characterize and evaluate the maximization of wet weather flows along with other LTCP alternatives required under CSM Part IV.G.4 to the BCUA WCPF as part of the regional CSO LTCP.

1.1 Receiving Water Quality

The NJDEP has established water quality standards for each of the receiving waters within the State of New Jersey based on whether they are freshwater or saline waters. The standards are based on both bacterial and physical/chemical standards such as levels of dissolved oxygen, turbidity, nutrients, pH, etc. Discharges from combined sewer overflows contribute pathogens, and thus the parameter of interest for CSOs is the bacterial standards. Bacterial standards are typically set with monthly mean and single sample maximums set at levels to protect the primary or intended use. The following outlines the bacterial standards and protected uses for each water quality classification:

Class	Description	Bacterial Standards	Monthly Mean	Single Sample Max	Protected Uses
SC	Saline Ocean	Entero	35	104	Primary Contact, Shellfishing
SE1	Saline Estuary	Entero	35	104	Primary Contact
SE2	Saline Estuary	Fecal	770	NA	Secondary Contact
SE3	Saline Estuary	Fecal	1500	NA	Secondary Contact
FW2	Fresh Water	E. coli	126	235	Primary Contact and Public Water Supply

The BCUA District is located primarily in the Hackensack River watershed, but also services municipalities in Bergen County along the Hudson River. The Hackensack River Watershed covers an area of approximately 200 square miles in northeastern New Jersey and southern New York. The drainage basin extends from Newark Bay at the southern end into New York State at its northern end. Existing water quality classifications for the Hackensack River are as follows:

- NJ/NY State Line to Oradell — FW2-NT (C1)
- Oradell to Confluence with Overpeck Creek — SE-1
- Overpeck Creek to Route 1-9 Bridge — SE-2
- Route 1-9 Bridge to Newark Bay — SE-3

As previously noted the BCUA does not own nor operate any combined sewer systems or CSO overflow pipes, which are owned and operated by the individual municipalities. The two combined sewer municipalities (Hackensack and Ridgefield Park) that discharge into the Hackensack River either directly or indirectly are in the estuary portions of the river and thus are not impacting freshwater segments of the river. The Hackensack River immediately adjacent to the City of Hackensack and the Village of Ridgefield Park is classified as SE-1. Accordingly, the two CSO outfalls in the City of Hackensack and four (4) of the CSO outfalls for the Village of Ridgefield Park discharge into SE-1 Waters.

Two CSO Outfalls located on the south side of the Village of Ridgefield Park are tributary to Overpeck Creek, which has a water quality classification of SE-2 in the section of the creek impacted by CSO discharges. There are tide gates on Overpeck Creek under the Turnpike that prevents saline waters from intruding into the freshwater segment upstream. The water quality classification in the freshwater section is FW2-NT (Non-Trout), however the existence of the tide gates indicates that the CSO outfalls in Ridgefield Park along Overpeck Creek are not impacting the freshwater segment of Overpeck Creek. The third combined sewer community within the BCUA Service District is the Borough of Fort Lee. Fort Lee is within the Hudson River drainage basin and their CSO overflow pipes discharge to the Hudson River. The Hudson River in the region of Fort Lee has a water quality classification of SE-1.

Figure 2 – Baseline Monitoring Sites

Compliance Baseline Monitoring (CBM) of the receiving waters associated with combined sewer municipalities/authorities in the NY/NJ Region was undertaken jointly by numerous permittees through the NJ CSO Group, including the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park. Overall monitoring of water quality undertaken as part of that effort is reported on in a separate report. Nevertheless, four of the monitoring locations were in receiving water areas immediately adjacent to the Borough of Fort Lee (31), the City of Hackensack (B1), and the Village of Ridgefield Park (B2 & B11). Sampling Sites B1 and B2 were on the Hackensack River, Site B11 was on Overpeck Creek, and Site 31 on the Hudson River.

The CMP was completed by CDM Smith and HDR Engineering in compliance with the Baseline Compliance Monitoring Program Quality Assurance Project Plan (QAPP) prepared by PVSC on behalf of the members of the NJ CSO Group. A total of twenty-three baseline and source sampling events were completed between April 17, 2016 and April 28, 2018. Graphical representation of the water quality data obtained at Sites B1, B2, B11, and 31 are illustrated in Figures 3 to 6.

The saline regions of the Hackensack River do appear on the 303(d) List of Water Quality Limited Waters primarily for chemical and pesticide contamination including, but limited to: Dioxin, Heptachlor epoxide, PCB in Fish Tissue, DDT and its metabolites in Fish Tissue, Mercury in Fish Tissue, Chlordane in Fish Tissue, and Dieldrin issues extending the full length of the Estuary from its confluence with Newark Bay up to the Oradell river gage. These contaminants impact the designated use of fish consumption for SE1, 2, and 3 classified waters. In addition, periodic low dissolve oxygen levels that impact aquatic life have been detected primarily in the SE-3 designated region, and periodic high enterococcus levels in the SE1 region of the river even in those regions not impacted by CSO discharges.

Overpeck Creek is also listed on the NJDEP 303(d) List of Water Quality Limited Waters for chemical and pesticide contamination including Chlordane in Fish Tissue, DDT and its metabolites in Fish Tissue, Dioxin, and PCB in Fish Tissue all of which impact the designated use of fish consumption for SE2 and FW2 waters. In addition, high levels of Escherichia coli (E-coli) were also detected in the FW-2 section of the Creek, which impacts recreation within the region. It should be noted that there are no CSO discharge outfalls within this segment of Overpeck Creek.

The Hudson River segment that borders New Jersey is also listed on the 303(d) lists. The SE-1 section of the river, known as the Hudson River (upper) runs from the NY-NJ border to the confluence of the Hudson and Harlem Rivers in New York. Impacts on this segment of the river are primarily related to fish consumption due to organic chemical accumulation in fish tissue including Chlordane, DDT and its metabolites, mercury, and PCB. In addition, dioxin, benzo(a)pyrene, dieldrin, and hexachlorobenzene in the waterway also impacts fish consumption. These same issues extend into the Hudson River (lower) segments, which has a SE-2 water quality classification.

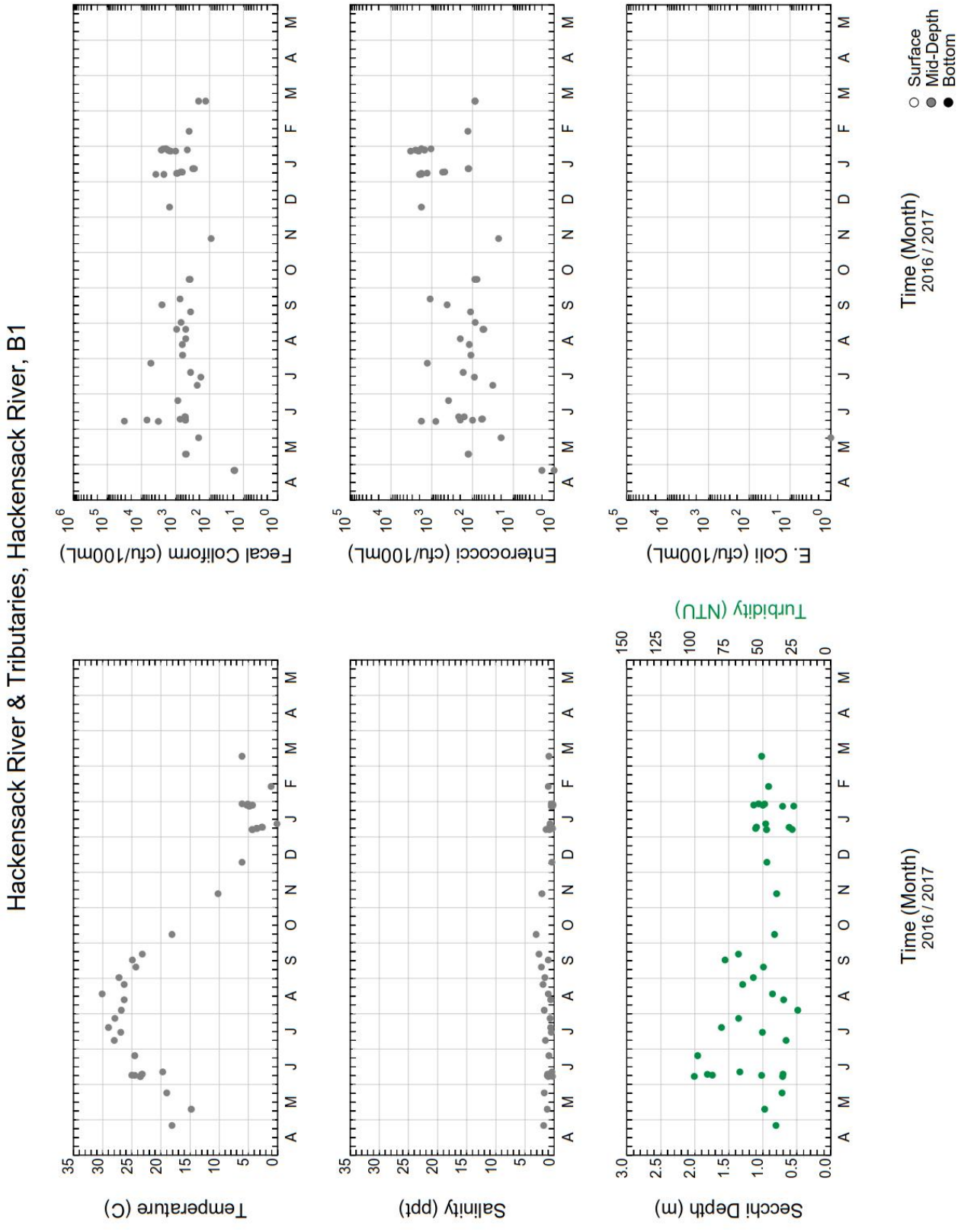

Figure 3 – Baseline Monitoring Data Site B-1

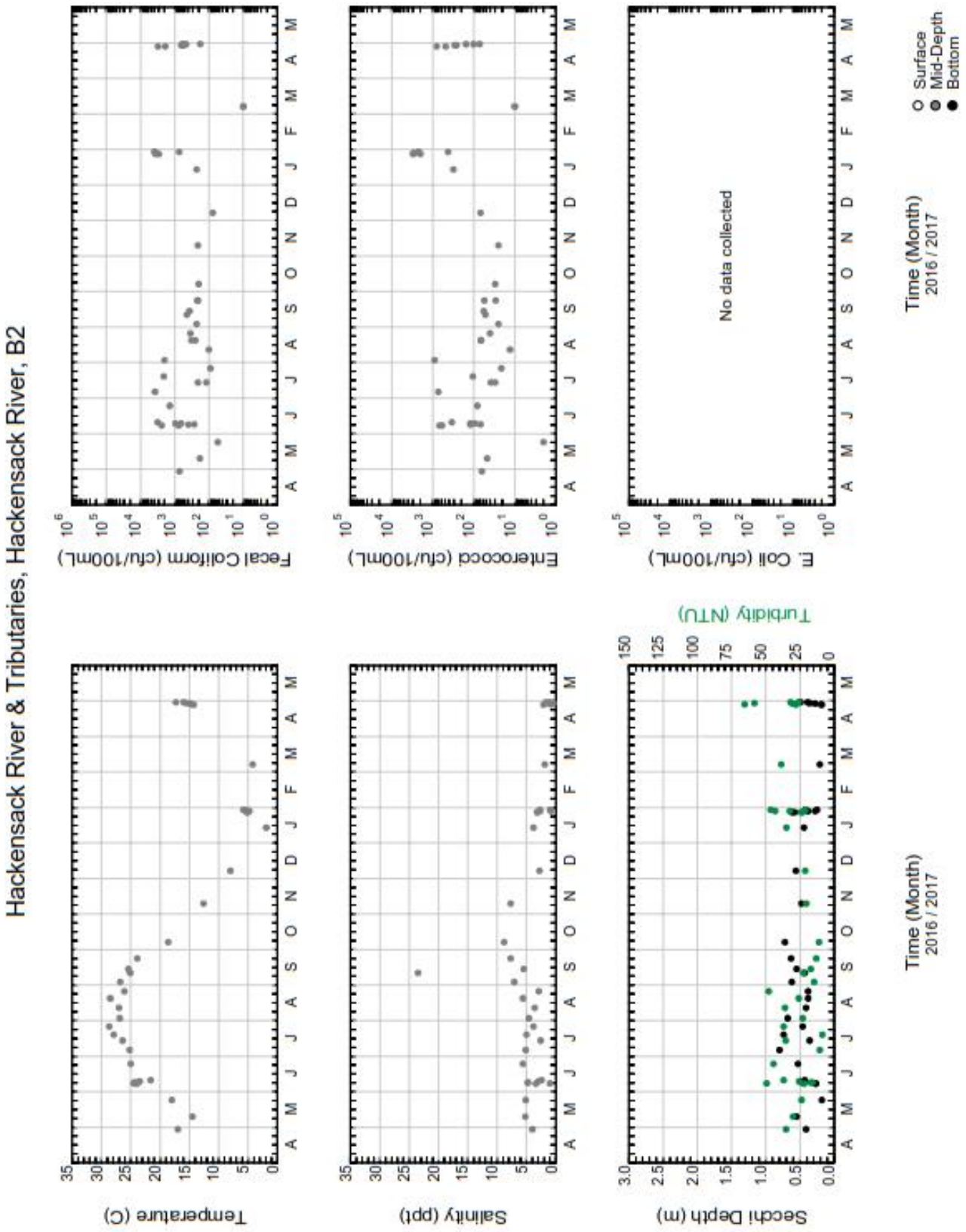

Figure 4 – Baseline Monitoring Data Site B2

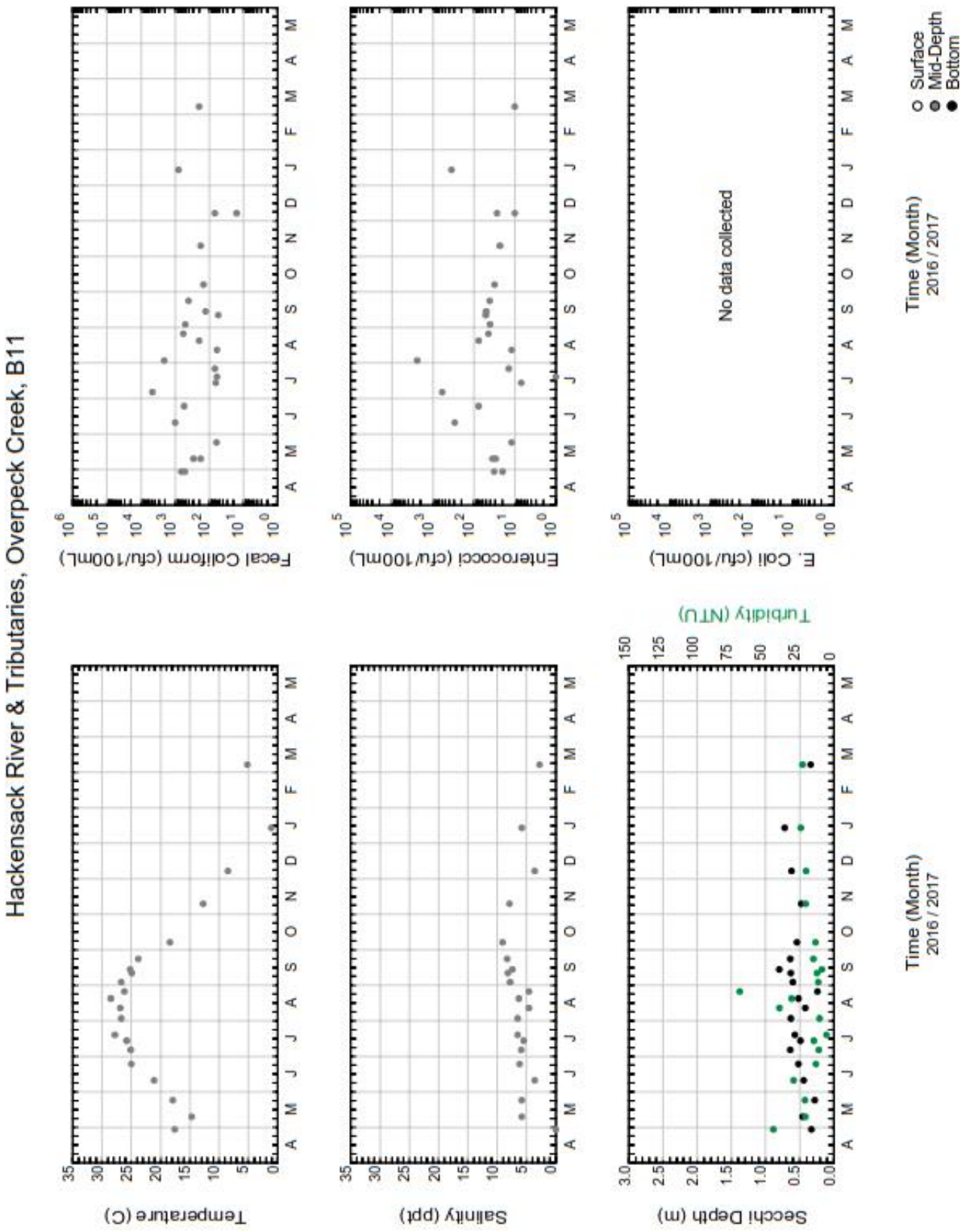

Figure 5 – Baseline Monitoring Data – Site 11

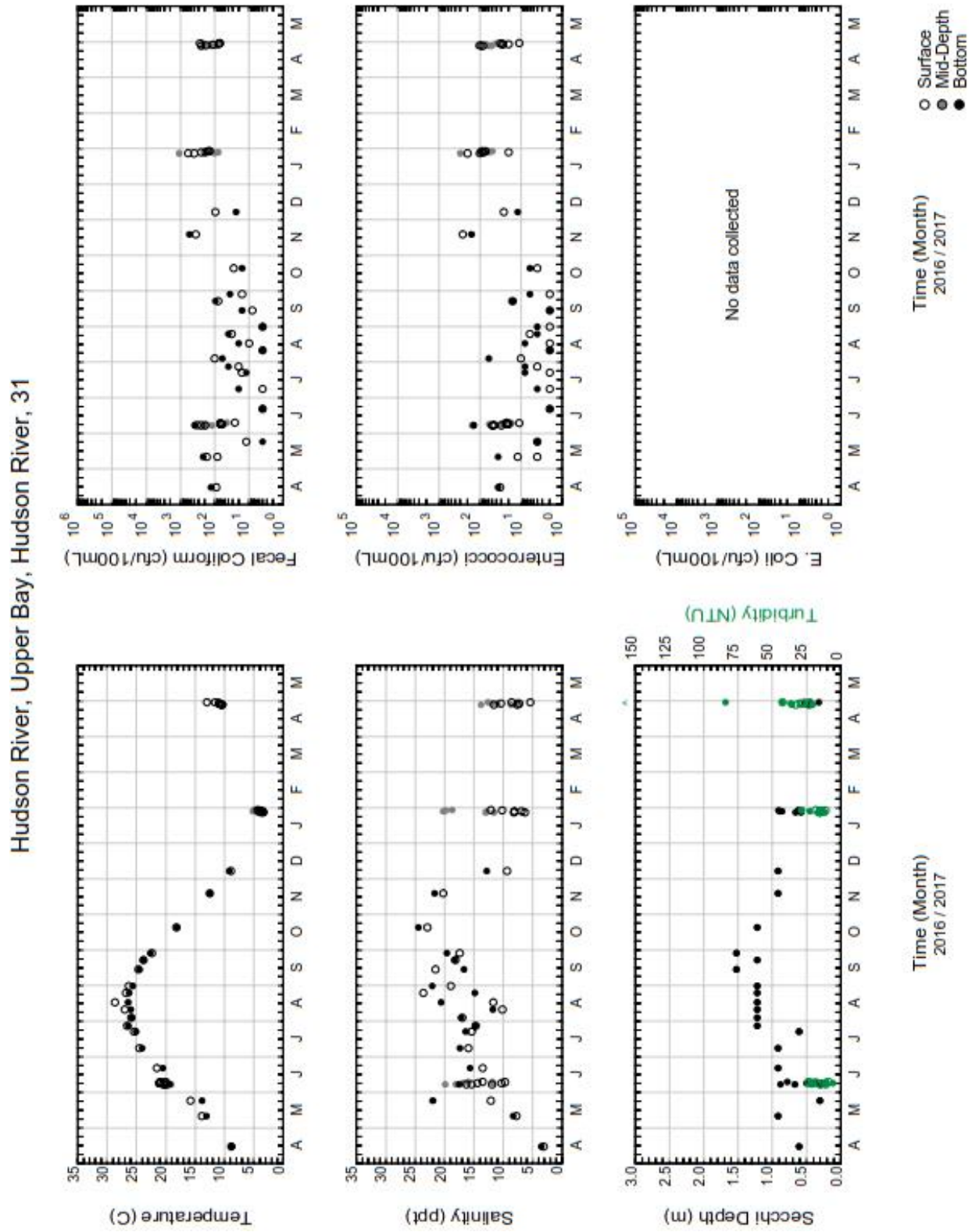

Figure 6 – Baseline Monitoring Data Site 31

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2 Project Description

Although the BCUA owns and operates the transport and treatment facilities within the District, it does not own, nor operate any combined sewer systems or CSO outfall facilities. The combined sewer systems and CSO Outfalls within the Borough of Fort Lee, City of Hackensack, and the Village of Ridgefield Park are owned and operated by each municipality. The CSO discharges from these municipalities potentially impact the lower Hackensack River, the tidal region of Overpeck Creek, and the Hudson River. In accordance with discussions with the NJDEP, the BCUA, Fort Lee, Hackensack, and Ridgefield Park have each undertaken their own System Characterization QAPPs/Studies of their combined sewer systems as needed to characterize their systems as required under their NJPDES permit. Presently, BCUA, Fort Lee, and Ridgefield Park all use the InfoWorks ICM collection system modeling software, while Hackensack collection system model uses PCSWMM. All four of these models were, or will be integrated together using InfoWorks ICM to create a single, comprehensive collection system model of the entire BCUA tributary network. To support the development of this integrated collection system model, the BCUA installed ten (10) temporary flow meters to characterize the flow as it progresses through the BCUA trunk sewer conveyance system to the WCPF. The municipal collection system models for Fort Lee, Hackensack, and Ridgefield Park as incorporated into the BCUA model were checked to verify that they generally match the models results reported by the respective municipalities.

Mott MacDonald has worked with the other BCUA CSO Group consultants to establish common modeling approach to facilitate the integration of the various models. The individual municipal models were developed, calibrated, and verified by each municipal consultant has been provided to Mott MacDonald for integration with the BCUA model. The Fort Lee and Ridgefield Park models were easily integrated into the BCUA model since they were also built using InfoWorks ICM. Since the Hackensack model was developed using PCSWMM it required conversion before integration into the BCUA Model. Mott MacDonald worked with the consultant for Hackensack to assure an accurate model conversion. Thus, we are confident that the integrated BCUA model will function properly so that an alternative analysis and the subsequent selection of alternatives for the LTCP can be evaluated with the final model.

2.1 Project Goals

A hydraulic and hydrologic collection system model (model) is a mathematical representation of a physical collection system developed with the goal of realistically mimicking the performance of that physical system. By ensuring a good model match to the physical collection system under known conditions, the model can be considered a reliable tool for understanding the system's performance under arbitrary conditions (such as the typical year conditions). Establishing the model as a reliable tool is critical since the model is the primary tool for assessing current system performance as well as for the planning, evaluation, and designing future system improvements. By developing a high-quality collection system model, the BCUA and its tributary communities will be able to evaluate system improvements that will meet operational and regulatory goals.

The BCUA Sewer System Characterization Report was undertaken to provide a framework for the collection of adequate data for the calibration and verification of a regional computer model that can be used as a tool in the development of a Regional CSO LTCP predicting:

- The performance of the existing BCUA trunk system under various system conditions versus the volumes and peak flow contributions to that system from the tributary communities;

- Identification of any trunk sewer system locations, if any, that are susceptible to backwater impacts, frequent surcharge, flooding, and/or general hydraulic overloading;

- Understanding how the operation and performance of the BCUA WPCFs affect flows being conveyed through the BCUA Trunk Sewers.

- Ultimately to develop (as part of the regional LTCP) a plan for maximizing flows to the WCPF in association with, knowledge of the capacity limitations of the existing flow transport and treatment systems.

As with any model, the quality and comprehensively of the input data exerts a significant influence on the reliability of the model to accurate portray current and potential conditions. The BCUA collection system model is built on two primary datasets detailed below:

- Physical Collection System Inputs represented by pipes, manholes, pump stations, other flow control elements, contributing drainage areas, etc.

- Environmental Inputs represented by rainfall data, flow meter data, debris and sediment data, river/tide elevation data, pollutant data, groundwater/antecedent moisture conditions, etc.

3 Sewer System Characterization

As described in Section 1, the primary goal for developing the BCUA collection system model is to build a reliable tool for characterizing the performance of the existing collection system and potential future improvements developed as part of an LTCP. The primary extents of the BCUA model include the BCUA's interceptor system assets (Trunk Sewers and WPCF). However, accurately simulating the contributions from the tributary communities (both combined and separate) will also be critical. Although point of connection flow meters are used where municipalities contribute their flow to the BCUA interceptor, the BCUA model must be able to estimate the flows that will be contributing from these communities under arbitrary rainfall conditions. The BCUA services forty-seven individual municipalities within the County and uses over 150 point of connection flow meters for billing. A review of average daily flows from the point of connection meters range from less than ten thousand gallons to several million gallons of wastewater flow per day. A review of average daily flows recorded during the period of analysis showed that forty-five (45) point of connection flow meters accounted for roughly 85% of the total flow contribution to the BCUA. Accordingly, it was determined that analysis of infiltration and inflow, and development of drainage basin and flow distribution needed to improve the accuracy of the BCUA model, would be restricted to these drainage basins and points of entry.

In addition to the simulation of wastewater flows from the forty-four separated sewered communities, a more detailed modeling effort is required for the tributary communities with combined sewer systems (Fort Lee, Hackensack, & Ridgefield Park). All three municipalities have developed and shared their calibrated and verified collection system computer models with BCUA. These models have been incorporated fully into the BCUA model and then reviewed and checked against the flows as predicted during their individual calibration and/or verification to assure that the imported model was consistent with the original. In cases where the community model has insufficient detail and accuracy within any drainage basin, a small section of piping immediately upstream of the points of connection will be incorporated into the BCUA model to more realistically depict the timing, volume, and distribution of flows added to BCUA's Trunk Sewers. Electronic input and output files of the InfoWorks model as well as the summary of parameters and results are provided in subsequent sections. A hard copy of the model input and output files shall be made available upon the Department's request.

3.1 Service Area Land Use Data

The BCUA transports wastewater flows from combined sewer systems through its Trunk Sewers however, the Authority does not own nor operate any of the collector sewers nor the CSO outfalls. These are owned and operated by the individual municipality (Fort Lee, Hackensack, and Ridgefield Park).

3.1.1 Borough of Fort Lee

The wastewater flows from the Borough of Fort Lee are primarily residential and are pumping into a branch truck sewer at two locations and then to the Overpeck Trunk that transports wastewater to the WCPF located in Little Ferry. The BCUA Trunk Sewers servicing the Borough of Fort Lee are illustrated in Figure 7. Additional information on the combined sewer systems within the Borough of Fort Lee can be found in the Borough of Fort Lee Sewer System Characterization Report as submitted to NJDEP.

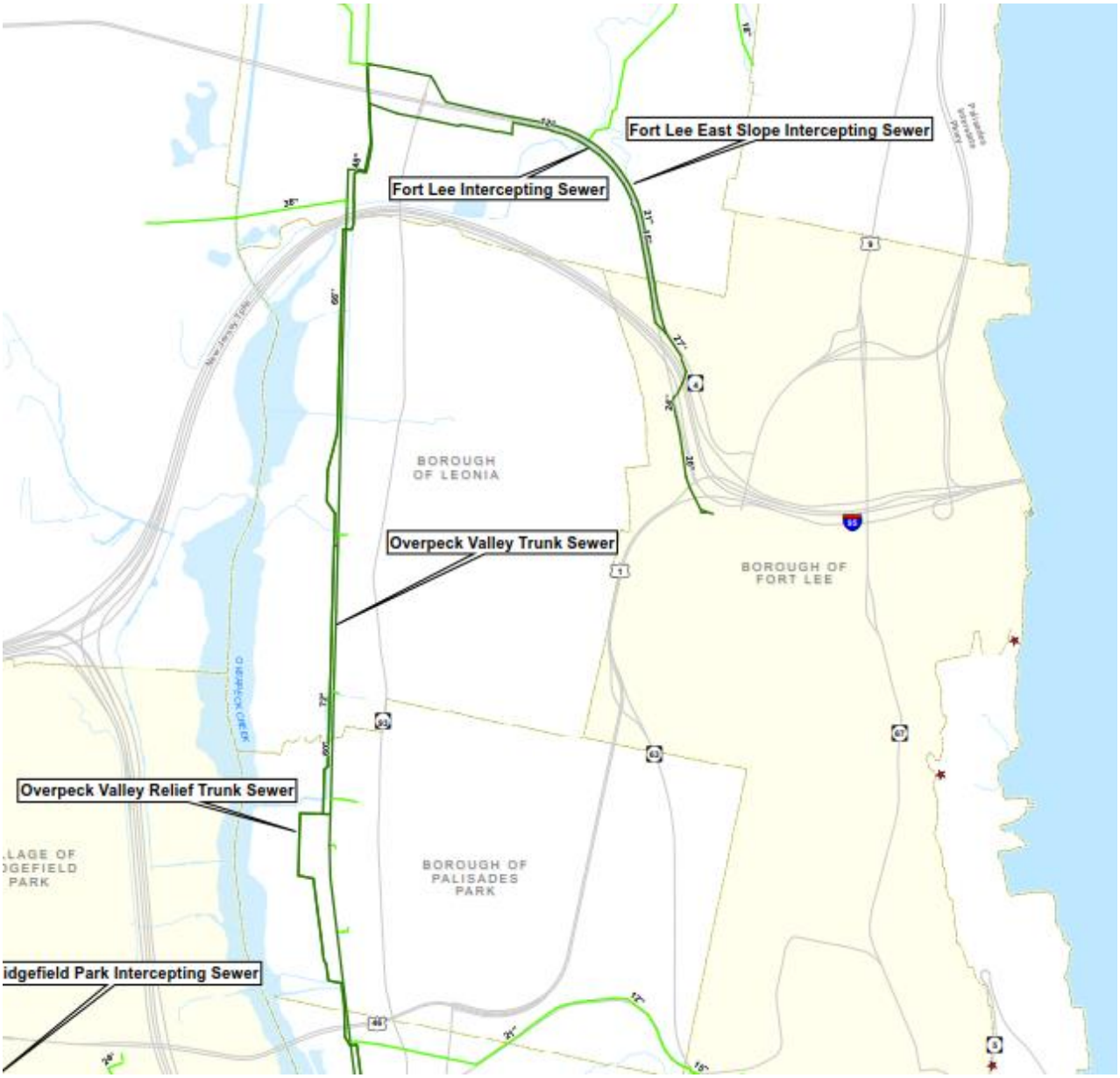

Figure 7 – Trunk / Intercepting Sewers Servicing Fort Lee

3.1.2 City of Hackensack

Wastewater flows from the City of Hackensack are primarily residential and flow by gravity to the BCUA Main (Hackensack Valley) Trunk Sewer, which transport flows to the WPCF in Little Ferry. The BCUA Trunk Sewers servicing the City of Hackensack are illustrated in Figure 8. Additional information on the combined sewer systems within the City of Hackensack can be found in the City of Hackensack Sewer System Characterization Report as submitted to the NJDEP.

Figure 8 - Trunk Sewers Servicing the City of Hackensack

3.1.3 Village of Ridgefield Park

Wastewater flows from the Village of Ridgefield Park are primarily residential and are flow by gravity to a branch trunk sewer and then the BCUA Overpeck Trunk/Relief Sewer, which transport flows to the WPCF in Little Ferry. The BCUA Trunk Sewers servicing the Village of Ridgefield Park are illustrated in Figure 9. Additional information on the combined sewer systems within the City of Hackensack can be found in the Village of Ridgefield Park Sewer System Characterization Report as submitted to the NJDEP.

It should be noted that while the BCUA does not own nor operate any CSO Outfalls it does own and operate three of the CSO Control Facilities within the Village of Ridgefield Park as illustrated below. These are Regulators R-1, R-2, and R-5.

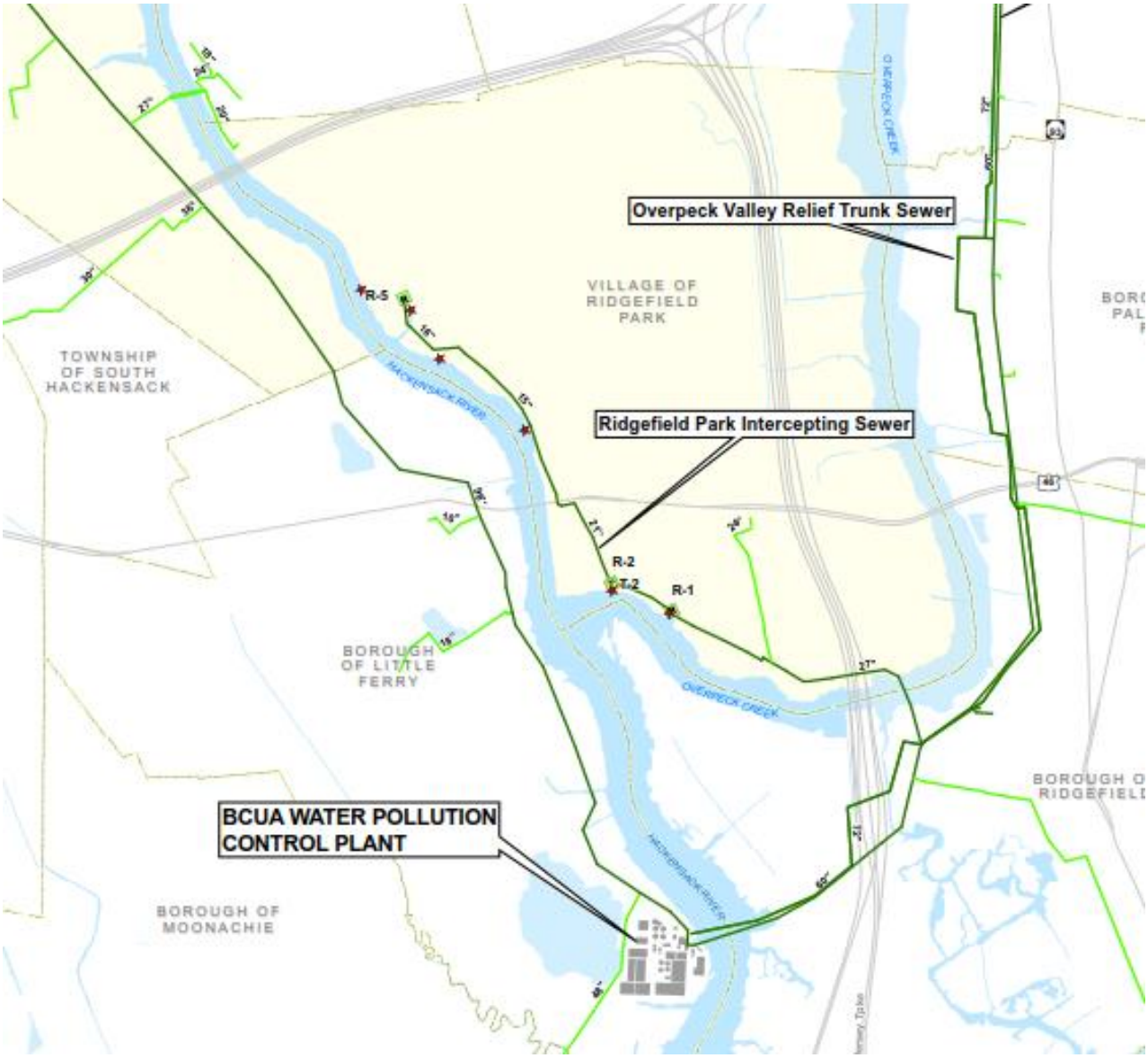

Figure 9 – Trunk / Intercepting Sewers Servicing the Village of Ridgefield Park

3.2 Monitoring of Background Conditions

Since the BCUA neither owns nor operates any combined sewer overflow discharge pipes, monitoring of water quality parameters was not undertaken by BCUA for this report. Monitoring of water quality parameters is the responsibility of individual municipalities with combined sewer systems and any water quality monitoring undertaken is included in their individual reports.

3.2.1 Previous Dry Weather Monitoring

The BCUA does not have any flow meters to measure wastewater flows in their truck sewers, but does own and maintain over 150 flow meters used for billing tributary flows just as they enter the trunk sewer. These meters are calibrated by BCUA field crews quarterly and thus provide accurate and long-term data on wastewater flows from each of the tributary drainage basin. Long-term flow measurements from these meters were used to develop diurnal dry weather flow curves for each basin analyzed.

3.2.2 Previous Wet Weather Monitoring

Long-term flow measurements from the BCUA billing meters were used to establish the influence of wet weather on the individual drainage basin related to the rainfall volumes and intensities that occurred during the monitoring period as related to individual stormwater return periods.

3.2.3 Need for Additional Data

As noted above there are no permanent meters located on the BCUA Trunk System that could be used to calibrate and verify the InfoWorks ICM model Accordingly, temporary flow meters were establish and used in conjunction with permanent meters used for billing to provide detailed information on the flow characteristics within the Trunk Sewer System. The follow sections provide more precise information on where temporary meters were installed and maintained.

3.2.4 Flow Monitoring Data Collection and Usage

Another data input used both for developing model inputs and evaluating model performance, is the flow monitoring data. Directly measuring flows within the collection system under a variety of conditions provides the basis for performing model calibration/validation. This flow monitoring data is also used to define certain model inputs, such the diurnal patterns during dry weather flow. The BCUA does not maintain any flow meters directly on its Trunk Sewer System. Accordingly, ten (10) temporary flow meters were installed along the BCUA trunk sewer system during 2017. BCUA does maintains over 150 permanent flow meters that directly measure flow contributions to the BCUA trunk sewer system from their member municipalities. Both permanent and temporary flow metering were used for model development.

Flow Assessment Services were retained as a sub-consultant by Mott MacDonald and was responsible for the installation, operation, maintenance, and extraction of flow information from temporary meters. The best flow monitoring data is collected in conditions with uniform non-turbulent flow. All proposed meter locations were field investigated to try and eliminate locations with adverse hydraulic conditions. After potential locations were vetted, all flow meters were tested for velocity and level accuracy prior to installation and were calibrated in place after installation. Each site was typically field visited monthly or, as needed if the recorded data indicated a potential problem. These field visits consisted of a visual inspection of all meter and sensor components, a review of previous period data to search for anomalies in the meter performance, and physical calibration of flow level.

Data from the meters were wirelessly transmitted back to a central server on a four-hour basis. Preliminary and final QA/QC of the data included checking the validity of each data point, flow balancing, and comparison of observed flow to expected flow (pipe rating curve). Metering data was periodically posted to a secure password protected website that allowed project personnel access to the flow and other data as needed.

Flow monitoring was conducted using an area-velocity flow meter. For velocity measurement, these meters use a continuous wave Doppler ultrasonic beam that provides an average of the entire flow profile. Levels were measured using a pressure sensor which converts the pressure measured at the sensor into a depth of the water column over the sensor. The pressure level sensor has the added advantage of measuring surcharge levels, and will operate accurately even if debris is present. All monitoring locations also had a supplementary ultrasonic down-looking sensor to provide redundant level information. The sensor measurements for the velocity and depth are converted into a flow rate considering the pipe diameter where the flow meter is installed.

The System Characterization Monitoring Program, as proposed in the BCUA Monitoring and Modeling Quality Assurance Program Plan (QAPP), and subsequently approved by the NJDEP consisted of a minimum four (4) month flow and rainfall monitoring effort. The study design was based on a combination of knowledge of the BCUA Interceptor Sewer Systems and professional judgment. The study was designed to provide an accurate characterization of the existing dry and wet weather flows into the BCUA Interceptor Sewer, including RDII flows from separately sewered areas. The monitoring sites were selected to capture hydraulically important locations that would provide significant insight into the hydraulic performance of the BCUA's interceptor system. The original monitoring site are illustrated in Figure 10.

There are four main interceptor sewers transporting flow to the BCUA WCPF: the Overpeck Valley Trunk Sewer; the Overpeck Valley Relief Sewer; the BCUA Main Trunk Sewer (District Sewer System Stage 2); and the Southern Interceptor servicing the municipalities of Lyndhurst, Rutherford, East Rutherford, Carlstadt, Moonachie, Woodridge, and Hasbrouck Heights. The Overpeck Trunk and Relief Sewers located east of the WPCF have six junction chambers where flows from the two sewers intersect. Accordingly, hydraulic grades and flows within these two sewers were monitored at the last junction chamber to verify model hydraulics. The manholes used for monitoring were established following a field check to verify that the metering sites were accessible and that the hydraulics are favorable for collecting high quality flow monitoring data. Several proposed metering locations had to be moved due to hydraulics or lack of access. The final monitoring and modeling manholes used are illustrated in Figure 11.

The following outlines the relative locations of metering site utilized during the monitoring period and some general information as to why the metering location was moved from the proposed location:

1. Flow metering was conducted on the lower end of the Overpeck Valley Trunk Sewer just downstream of the last junction chamber before the WPCF (Meter 1). The meter location was moved upstream from the proposed location due to hydraulics and access issues. This meter reported negative flows during all dry weather periods (flow towards Junction Chamber 1) and only reversed flows towards the WPCF during significant wet weather events. It is suspected that the sewer has a negative slope for at one downstream reach causing dry weather flows being directed towards the chamber and into the 72" relief sewer. A 36-inch connection is located at the first manhole downstream of Junction Chamber 1.

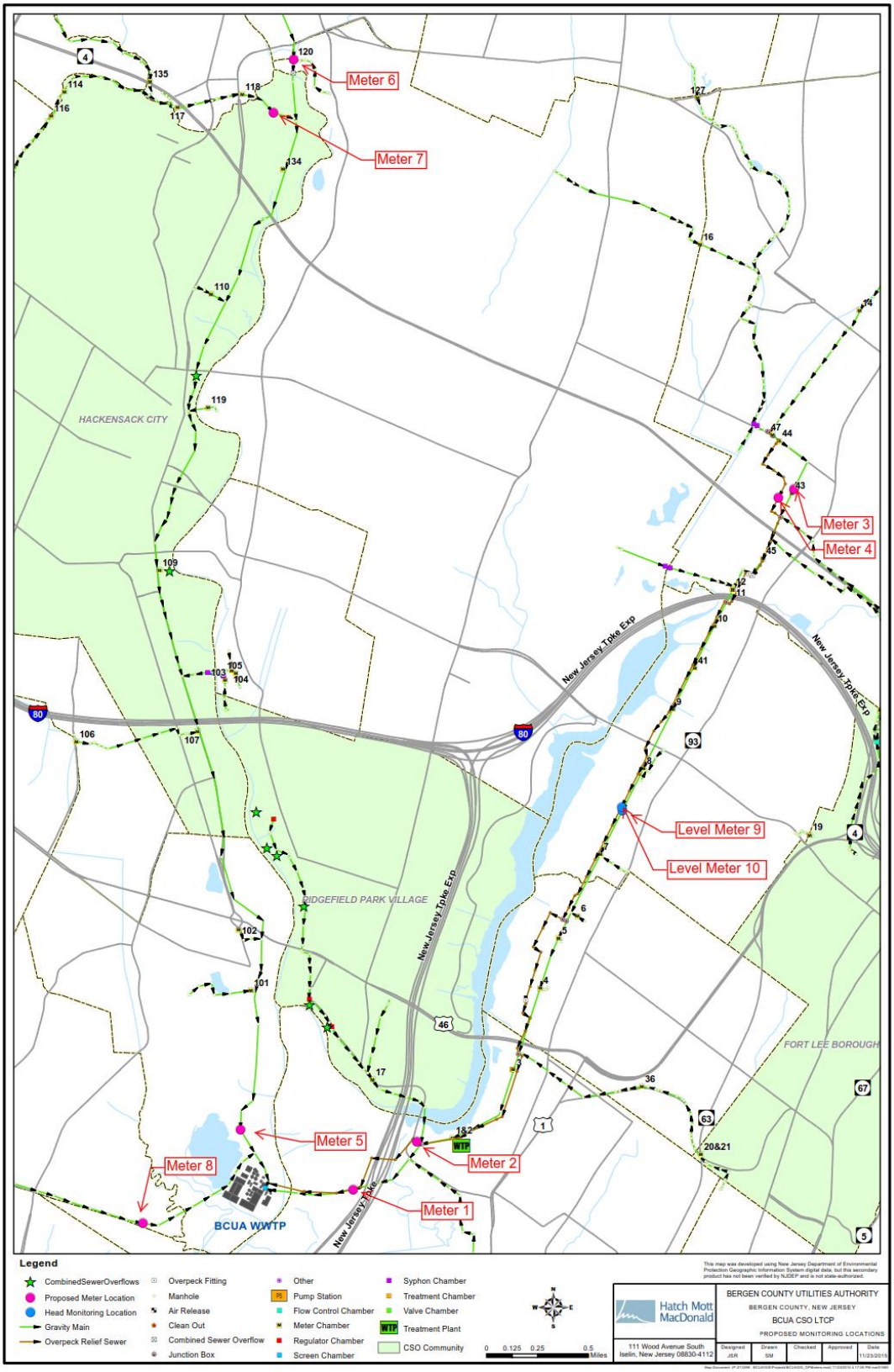

Figure 10 - Proposal Temporary Monitoring Sites

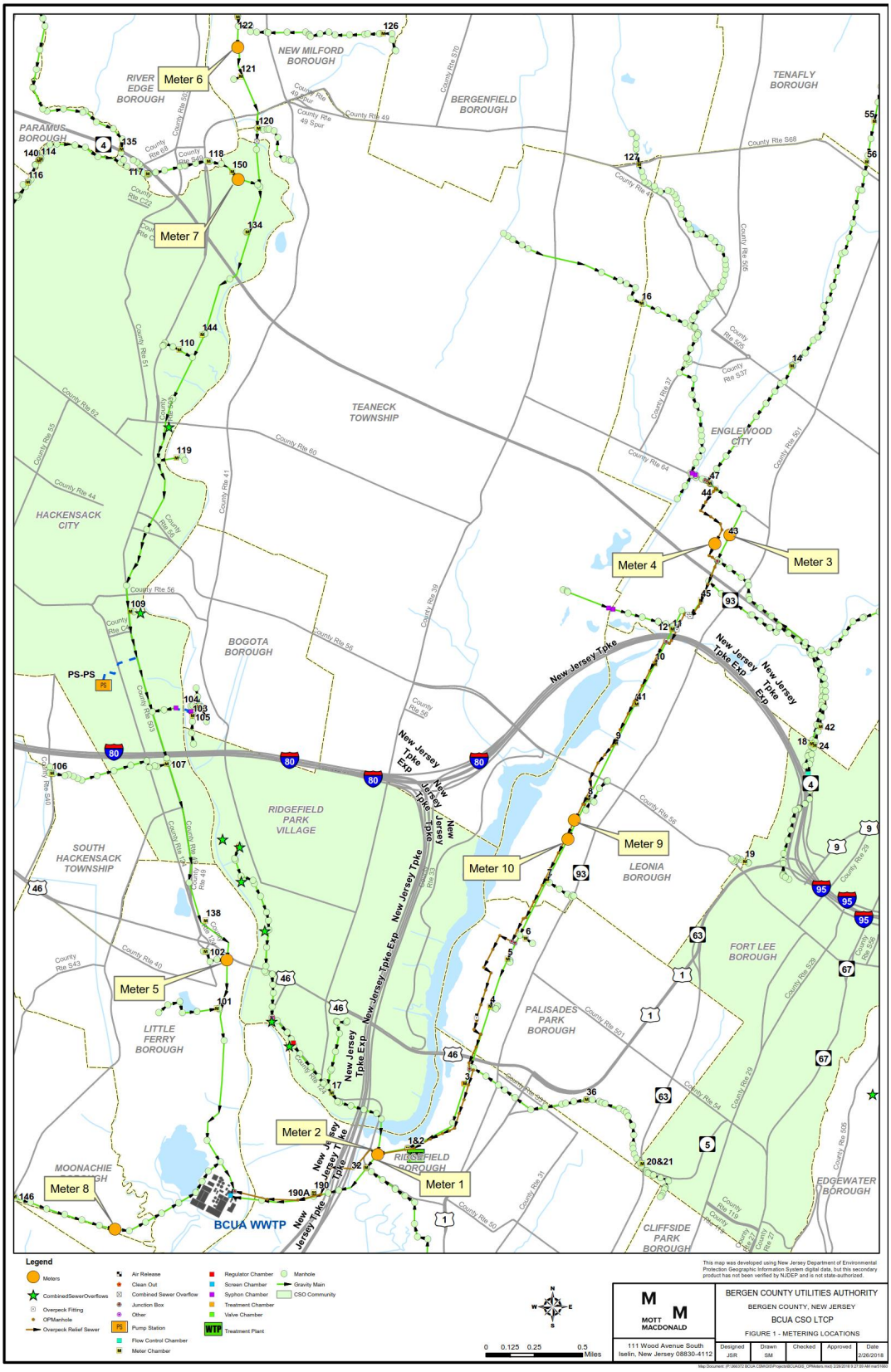

Figure 11 - Final Temporary Monitoring Sites

2. Flow metering was conducted on the lower end of the Overpeck Valley Relief Sewer just downstream of the last junction chamber before the WPCF (Meter 2);

3. Flow metering was conducted on the upper end of the Overpeck Valley Trunk Sewer in Englewood as an upper boundary condition to the model (Meter 3);

4. Flow metering was conducted on the upper end of the Overpeck Valley Relief Sewer in Englewood as an upper boundary condition to the model (Meter 4);

5. Flow metering was conducted on the lower end of the Main Interceptor Sewer relatively near the WPCF (Meter 5). The meter was originally intended to be installed closer to the WPCF, however access issues resulted in the meter being moved further upstream;

6. Flow metering was conducted on the upper end of the Main Interceptor Sewer in New Milford as an upper boundary condition to the model (Meter 6). The proposed meter location was at the boundary of Hackensack, however access and hydraulic issue necessitated moving the monitoring location into New Milford;

7. Flow metering was conducted on the lower end of the Paramus, Maywood, River Edge Branch Trunk Sewer just upstream of the Main Interceptor Sewer in Hackensack as another upper boundary condition to the model (Meter 7).

8. Flow metering was conducted on the Southern Interceptor Sewer near the WPCF (Meter 8).

9. Water surface elevations were monitored in the Overpeck Creek Trunk Sewer in Leonia (Meter 9). The metering location was moved one manhole upstream due to access issues.

10. Water surface elevations were monitored in the Overpeck Creek Relief Sewer in Leonia (Meter 10).

In addition to the temporary monitoring as described above as noted above, the BCUA maintains permanent meters on all wastewater discharges into the BCUA Trunk Sewer System. These meters are maintained for billing purposes, but were used as input in the development of the BCUA model. Long term data from the forty-five largest permanent meters were used with SSOAP Toolbox to evaluate and simulate RDII (Rainfall Induced Infiltration and Inflow) for assessments of flows for long term model simulations. The forty-five metering locations represent 85% of the total flow into BCUA. The forty-five meters used directly in the calibration/verification of the model are detailed in Table 3-1 ranked by average daily flow. Overall the forty-five meters range in average daily flow from approximately a low of 0.40mgd/day to about 4.0 mgd/day.

Table 3-1 – BCUA Billing Meters Used for Calibration/Verification

METER ID ID	MUNI ID ID	AVERAGE FLOW [MGD]	Subtotal (MGD)	Percentage of Total Flow
M047	Englewood	3.990	3.990	5.3%
M024	Fort Lee	3.849	7.839	10.5%
M070	Edgewater PS Effluent	3.654	11.493	15.4%
M109	Hackensack	3.597	15.090	20.2%
M135	Paramus	3.491	18.581	24.9%
M116	Maywood	3.033	21.614	28.9%
M128	Bergenfield	2.932	24.546	32.9%
M261	Joint Meeting PS	2.634	27.180	36.4%
M040	Cresskill	2.350	29.530	39.5%
M012	Teaneck	2.273	31.803	42.6%
M021	Fort Lee	1.964	33.767	45.2%
M017	Ridgefield Park	1.839	35.606	47.7%
M103	Hackensack	1.724	37.330	50.0%
M129	Dumont	1.662	38.992	52.2%
M022	Fairview	1.633	40.625	54.4%
M035	Tenafly	1.517	42.142	56.4%
M190	PSEG	1.419	43.561	58.3%
M240	Rutherford	1.412	44.973	60.2%
M005	Palisades Park	1.397	46.370	62.1%
M119	Teaneck	1.377	47.747	63.9%
M016	Teaneck	1.098	48.845	65.4%
M028	Englewood Cliffs	0.998	49.843	66.7%
M270	Hasbrouck Heights	0.993	50.836	68.1%
M131	Oradell	0.983	51.819	69.4%
M104	Bogota	0.872	52.691	70.5%
M252	Carlstadt	0.819	53.510	71.6%
M136	Emerson	0.773	54.283	72.7%
M011	Englewood	0.721	55.004	73.6%
M350	Washington Township	0.719	55.723	74.6%
M125	River Edge	0.685	56.408	75.5%
M416	Closter	0.668	57.076	76.4%
M230	Woodridge	0.635	57.711	77.3%
M130	Dumont	0.602	58.313	78.1%
M301-M302X	River Vale OS	0.489	58.802	78.7%
M061	Cliffside Park	0.485	59.287	79.4%
M010	Leonia	0.459	59.746	80.0%
M321	Woodcliff Lake OLD	0.428	60.174	80.6%
M006	Palisades Park	0.428	60.602	81.1%
M120	Teaneck	0.421	61.023	81.7%
M123	New Milford	0.418	61.441	82.3%
M153	Westwood	0.412	61.853	82.8%
M157	New Milford	0.412	62.265	83.4%
M260	East Rutherford SA	0.407	62.672	83.9%
M020	Cliffside Park	0.402	63.074	84.4%
M310	Hillsdale	0.399	63.473	85.0%

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4 Trunk/Combined Sewer System Characteristics

The BCUA owns and operates individual, but connected Trunk Sewers and Branch Intercepting Sewers that were constructed over the years to extend wastewater service to different areas of Bergen County. The three municipalities with combined sewer systems are all located at the southern end of the District and were among the first municipalities serviced by the BCUA. The combined sewer municipalities are serviced by either the Overpeck Valley Trunk Sewer (Borough of Fort Lee and the Village of Ridgefield Park) or the BCUA Main Trunk Sewer, constructed as the District Sewer System Stage 2 (Hackensack), which services municipalities along the Hackensack River and extends from the BCUA WPCF in Little Ferry north toward New York State. A map illustrating the separate and combined sewer municipalities serviced by the BCUA Service District Sewer System was previously provided as Figure 1.

4.1 Sewer System Updates or Modifications

The BCUA Overpeck Valley Trunk Sewer (OVTS) was constructed in the 1940's and put into operation in 1951. The OVTS is constructed of Reinforced Concrete Pipe (RCP and ranges in size from 60-inch diameter pipe at the WPCF to 27-inch diameter pipe at its upstream extent in Tenafly. The OCTS was experiencing capacity issues during extreme wet weather events in some part due to the hydraulic grades in the wet well. Hydraulic calculations conducted in 1999 indicated that the operating level in the wet well was creating a backwater condition on the initial 4,500 linear feet of the trunk. Subsequently, the BCUA undertook the design and construction of a parallel Overpeck Trunk Relief Sewer to eliminate capacity issues in the region. The Overpeck Trunk Relief Sewer was completed and put into operation in 2011.

Overpeck Trunk and Relief Sewers Interconnections

The existing Overpeck Valley Trunk Sewer (Trunk Sewer) consists of 42″, 48″ and 60″ reinforced concrete sewer pipe and extends from Englewood to the wastewater treatment plant in Little Ferry. Sewage flow is added to the relief sewer along the route at approximately fifteen (15) locations. The Overpeck Valley Relief Sewer (Relief Sewer) was constructed parallel to the existing OVTS sewer and is interconnected with the existing system. Flow Schematic Drawings FS-1 and FS-2 were developed as part of the design drawings to show the system in schematic form. All sewer connections to the system continue to be connected to the existing Trunk Sewer, exception for Fort Lee sewer connections at Van Nostrand Avenue and Rockwood Place. These sewers were connected directly to the new Relief Sewer. The Trunk and Relief Sewers are interconnected along the route by six (6) Junction Chambers and two (2) Interconnections. Junction Chambers were designed to combine the flow in the Trunk and Relief sewers and to redistribute the flow downstream between the new and old sewers. The Junction Chambers are located where the Relief Sewer must cross the existing Trunk Sewer. Interconnections No. 1 and No. 2 are designed to allow flow from the existing Trunk Sewer to flow into the new Relief Sewer in order relieve a high flow condition in the Trunk.

The total wastewater flows are shared by both sewers and both systems will operate together. The system is designed to automatically provide hydraulic relief to the Trunk Sewer by allowing the flow to split between the existing and new systems at each Junction Chamber and to allow the excess flow in the Trunk Sewer system to be relieved at Interconnections No. 1 and No. 2. In addition, each Junction Chamber includes stop log guides and removable precast concrete planks to allow the various reaches of sewer to be isolated for routine maintenance or emergency repairs. The Flow Schematic Drawings FS-1 and FS-2 from the

Design Drawings are illustrated in sections together with a general description of the overall system as follows:

Section 1 - Connection at West Forest Avenue to Junction Chamber No. 6

The existing 42″ Trunk Sewer is paralleled by a new 42″ Relief Sewer in this area. A doghouse Manhole MH-65 was constructed over the existing 42” Trunk at the intersection of West Forest Avenue and South Van Brunt Street to interconnect the existing and new parallel sewer. (See Figure 12)

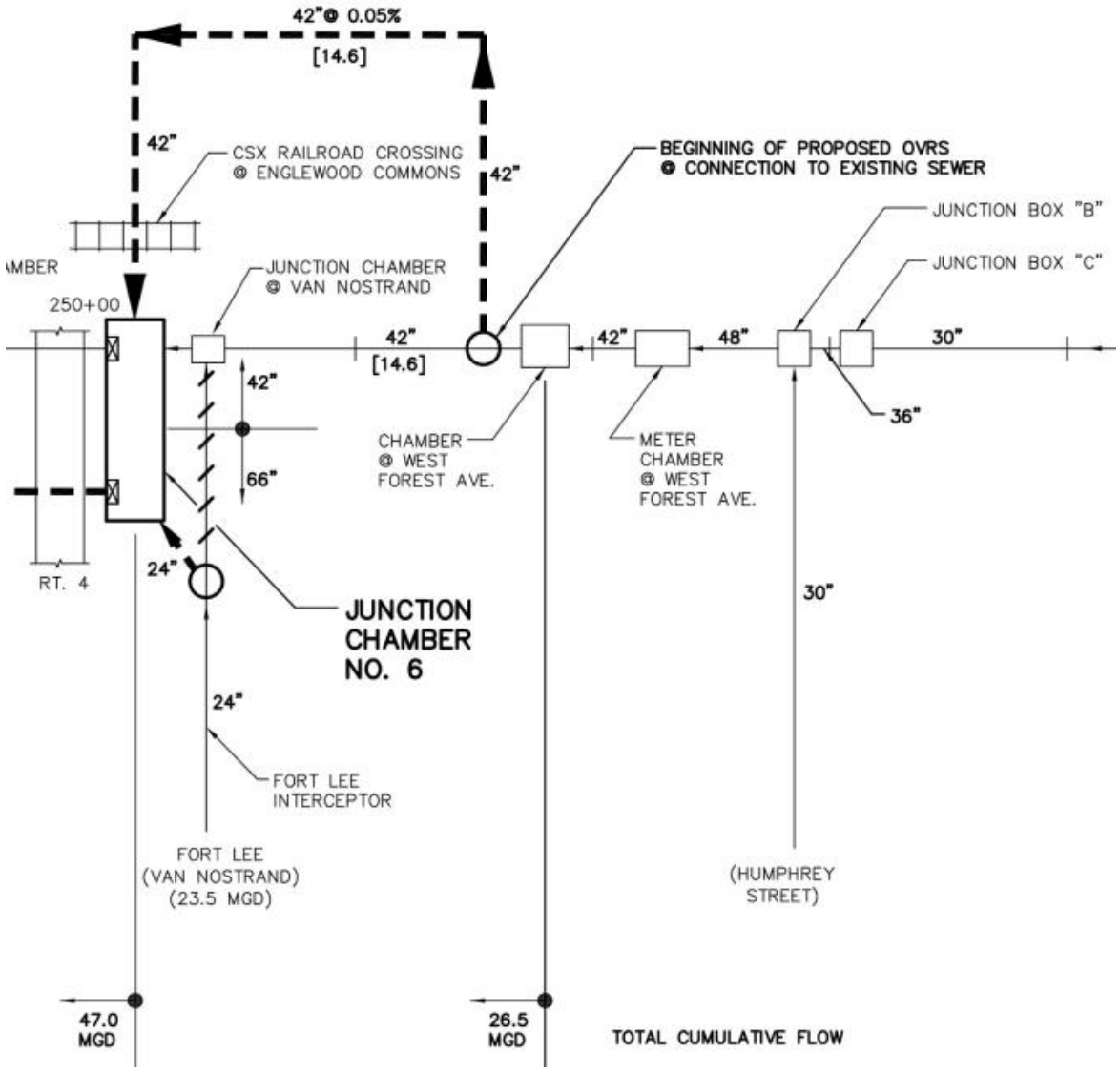

Figure 12 - Sheet F2 Section 1

Section 2 - Junction Chamber No. 6 to Junction Chamber No. 5

Junction Chamber No. 6 is located in South Dean Street in Englewood and serves to interconnect the flow from the existing and new 42″ sewers. In addition, the existing 24″ sewer form Fort Lee now connects directly to the chamber. This 24″ sewer carries heavy flows during wet weather which previously caused backups in the existing 42″ trunk sewer. A new 66″ relief sewer will parallel the existing 42″ and 48″ sewers from Junction Chamber No. 6 to No. 5 and has greatly increase the hydraulic capacity. (See Figure 13.)

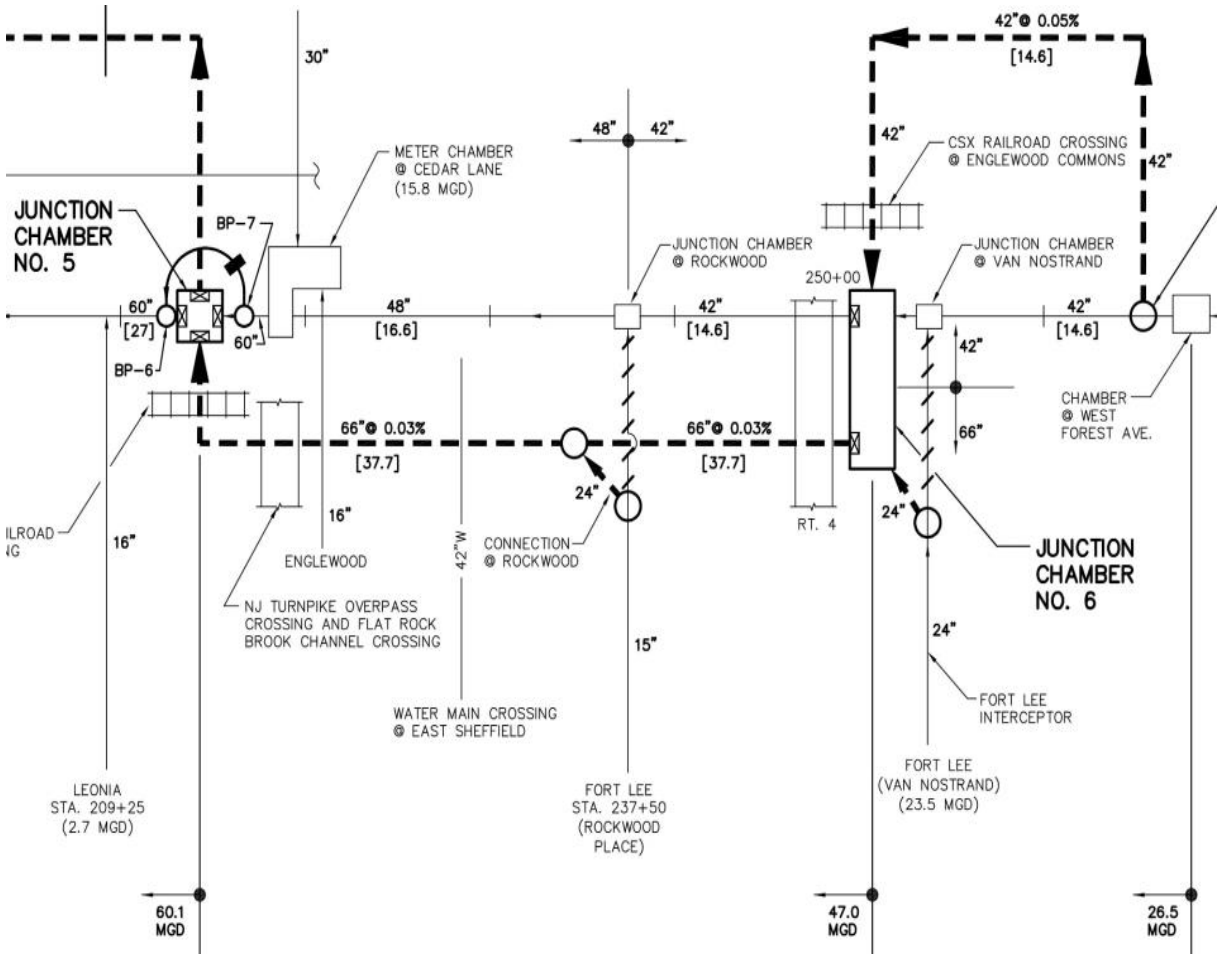

Figure 13 - Sheet F2 Section 2

Section 3 - Junction Chamber No. 5 to Interconnection No. 2

Junction Chamber No. 5 is located just downstream of the large BCUA Meter Chamber that serves Teaneck and Englewood. The Chamber interconnects the existing 60″ Trunk Sewer with the new 66″ Relief Sewer. In addition, the chamber allows the new relief sewer to cross from the east side of the trunk sewer system to the west side which was necessary for construction. The chamber also relieves the hydraulic overloading of the existing Trunk Sewer system by splitting the incoming flow between trunk and new relief sewer

systems. A new 66″ Relief Sewer parallels the existing Trunk Sewer from Junction Chamber No. 5 to Interconnection No. 2 and greatly increase the hydraulic capacity of the system. (See Figure 14)

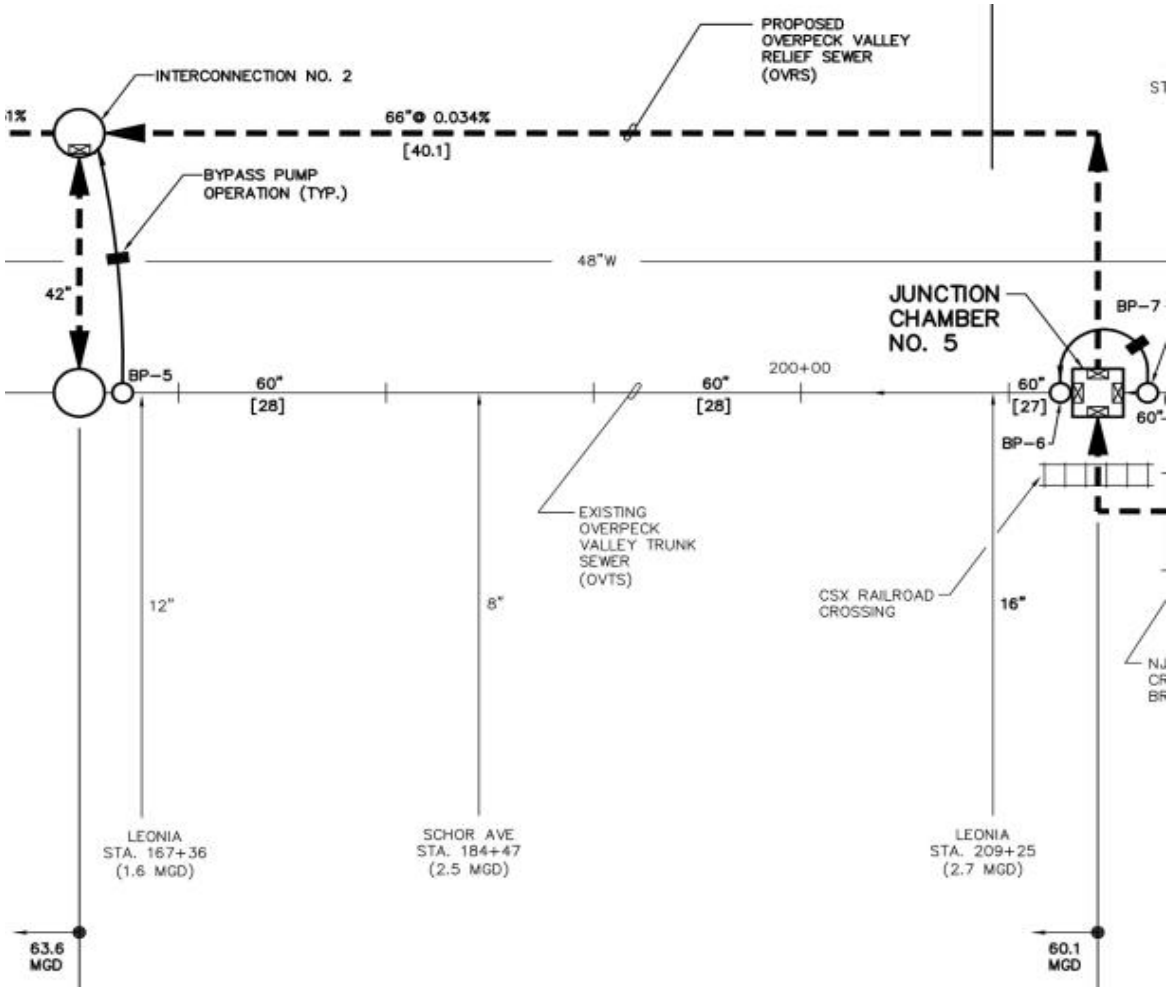

Figure 14 - Sheet F2 Section 3

Section 4 - Interconnection No. 2 to Junction Chamber No. 4

Interconnection No. 2 is located within the Bergen County Equestrian Center. The interconnection includes a doghouse manhole constructed over the existing 60″ Trunk Sewer and a new manhole constructed as part of the new Relief Sewer. A new 42″ sewer interconnects these two manholes which are separated by the existing United Water Company 20-foot wide easement and 48-inch diameter water main. The 42" sewer directly interconnect the existing 60” Trunk to the new 72” Relief Sewer. Interconnection No. 2 allows

any excess flow from the existing 60″ Trunk Sewer to enter the new 72″ Relief Sewer through the interconnection pipe. This interconnection allows the overall system to act hydraulically as a single system with a greatly increased flow capacity. A 72" Relief Sewer parallels the existing 60″ Trunk Sewer from Interconnection No. 2 to Junction Chamber No. 4. (See Figure 15)

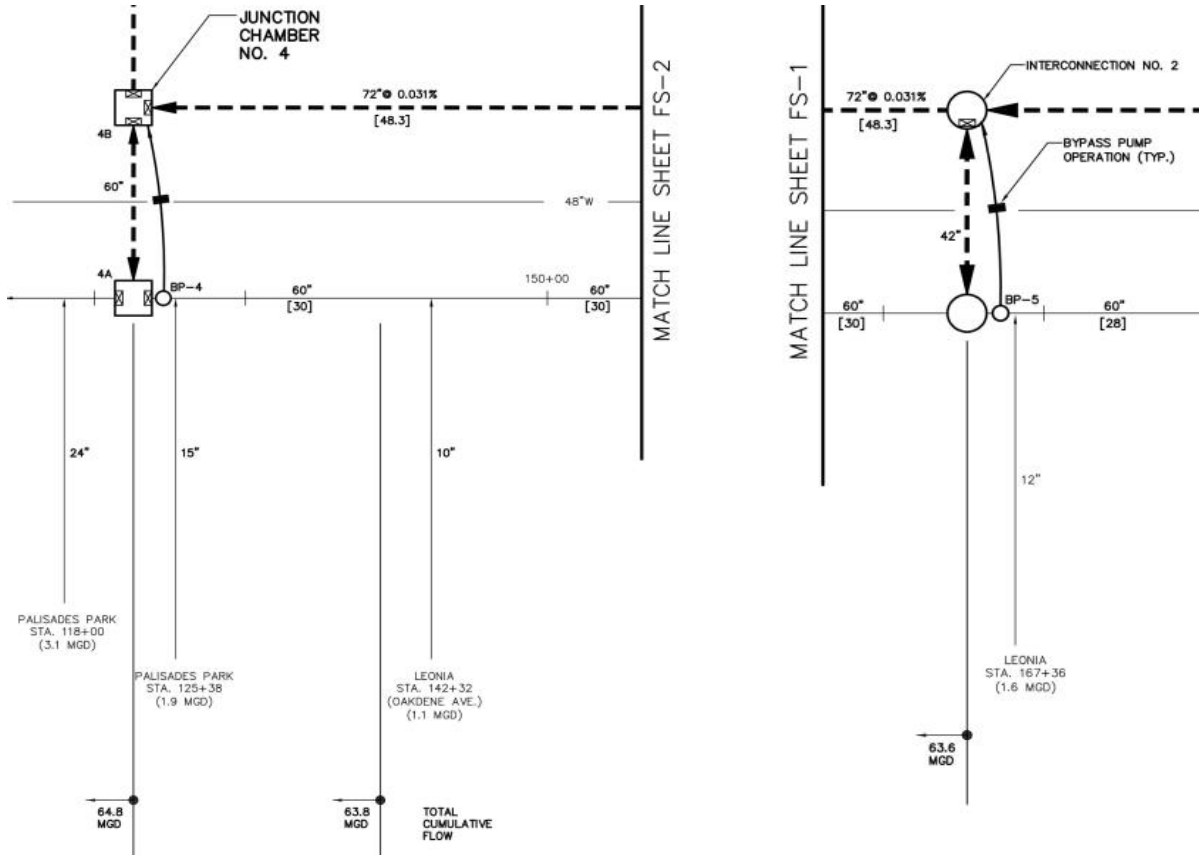

Figure 15 - F1 Section 4

Section 5 - Junction Chamber No. 4 to Interconnection No. 1

Junction Chamber No. 4 is located in Bergen County Overpeck Preserve area just north of the Shop Rite in Palisades Park. The chamber includes Chamber 4A which will be constructed over the existing 60” OVTS sewer and Chamber 4B which was constructed as part of the new OVRS sewer. A new 60” sewer will interconnect Chambers 4A and 4B, which are separated by the existing United Water Company 20-foot wide easement and the 48-inch diameter water main. Junction Chamber 4 allows excess flow from the existing 60” OVTS sewer to enter the new 72” OVRS sewer through the interconnection pipe. This interconnection allows the overall system to act hydraulically as a single system with a greatly increased flow capacity. A new 72” OVRS sewer parallels the existing 60″ OVTS sewer from Junction Chamber No. 4 Interconnection No.1. (See Figure 16)

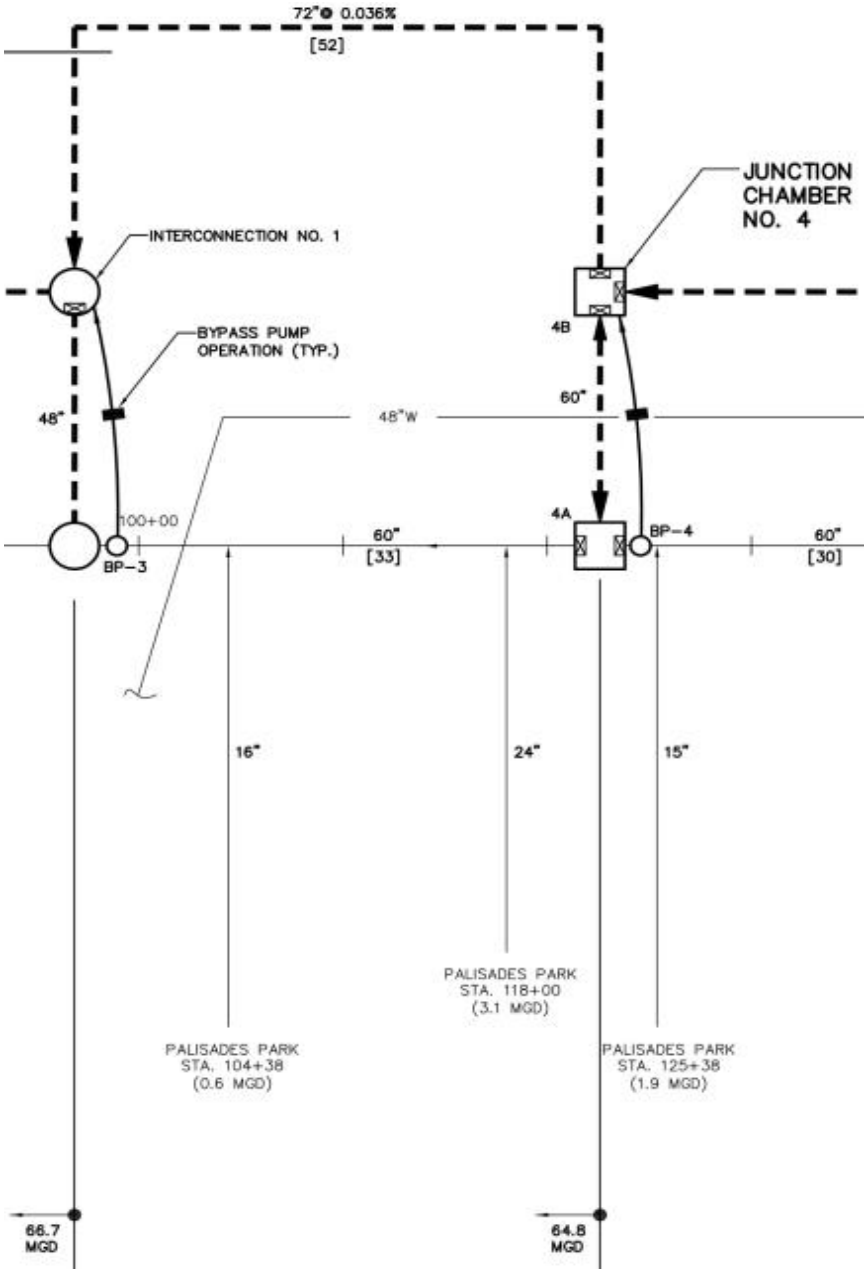

Figure 16 - Sheet F1 Section 5

Section 6 - Interconnection No. 1 to Junction Chamber No. 3

Interconnection No. 1 is located just south of the Palisades Park Sports Facility. The Interconnection consists of Manhole MH-16B, which was constructed directly over the existing 60” OVTS sewer, and Manhole MH – 16A, which was constructed as part of the new OVRS sewer. A new 48" sewer interconnects Manholes 16A and 16B and directly interconnects the existing 60″ OVTS sewer with the new 72″ OVRS sewer. The interconnection relieves any excess flow from the existing OVTS system and transfer

it to the new sewer. A new 72″ OVRS sewer parallels the existing 60″ OVTS sewer from Interconnection No. 2 to Junction Chamber No.3. (See Figure 17)

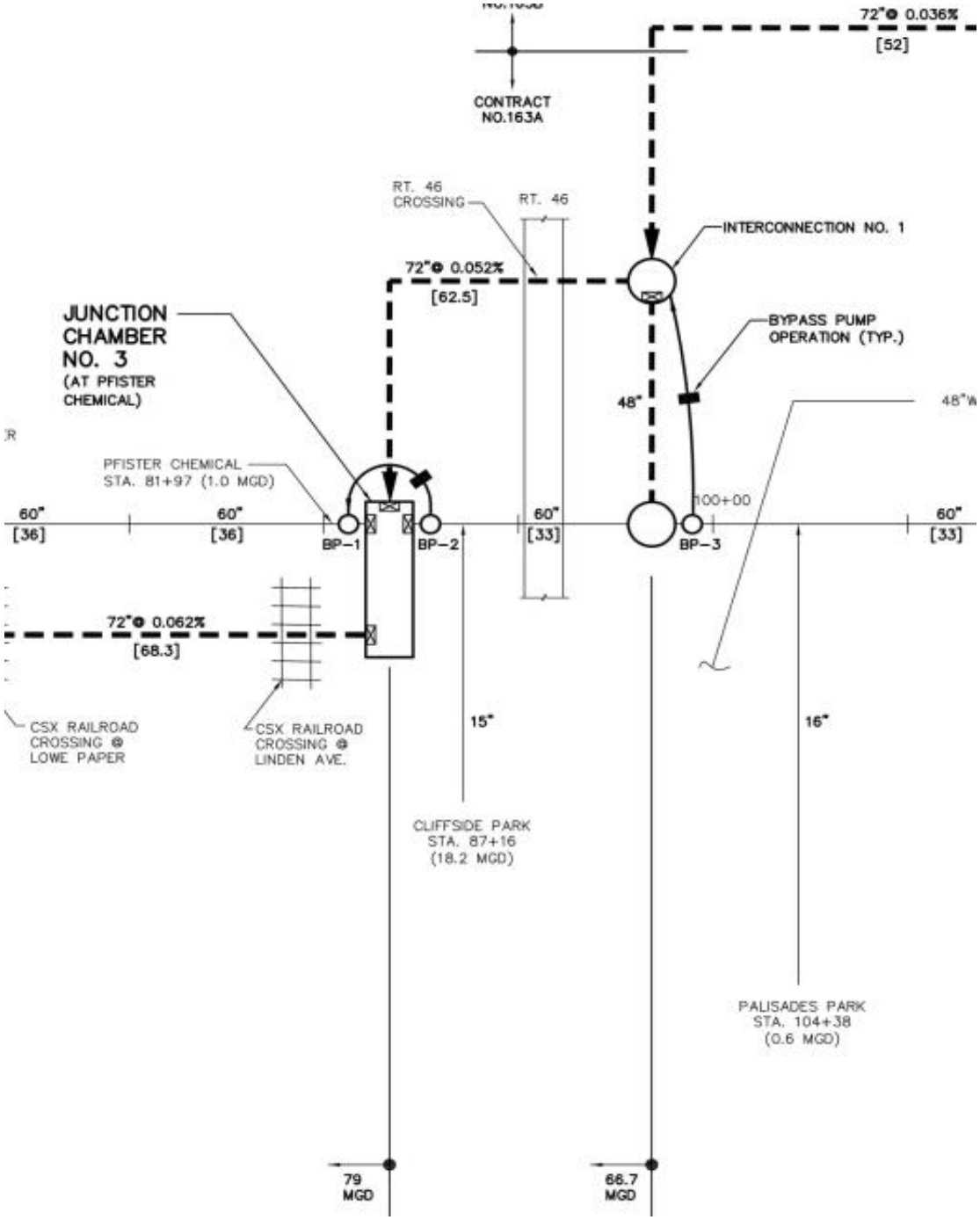

Figure 17 - F1 Section 6

Section 7 - Junction Chamber No. 3 to Junction Chamber No. 2

Junction Chamber No. 3 is located just south of Route 46. The chamber directly interconnects the existing 60″ OVTS sewer with the new 72″ OVRS sewer. In addition, the chamber allows the new OVRS sewer to cross from the west side of the existing OVTS system to the east side, which was necessary for construction purposes. The chamber relieves the hydraulic overloading of the existing OVTS system by splitting the incoming flow between the existing and new systems. A new 72″ OVRS sewer parallels the existing 60″ OVTS sewer from Junction Chamber No. 3 to No. 2. (See Figure 18)

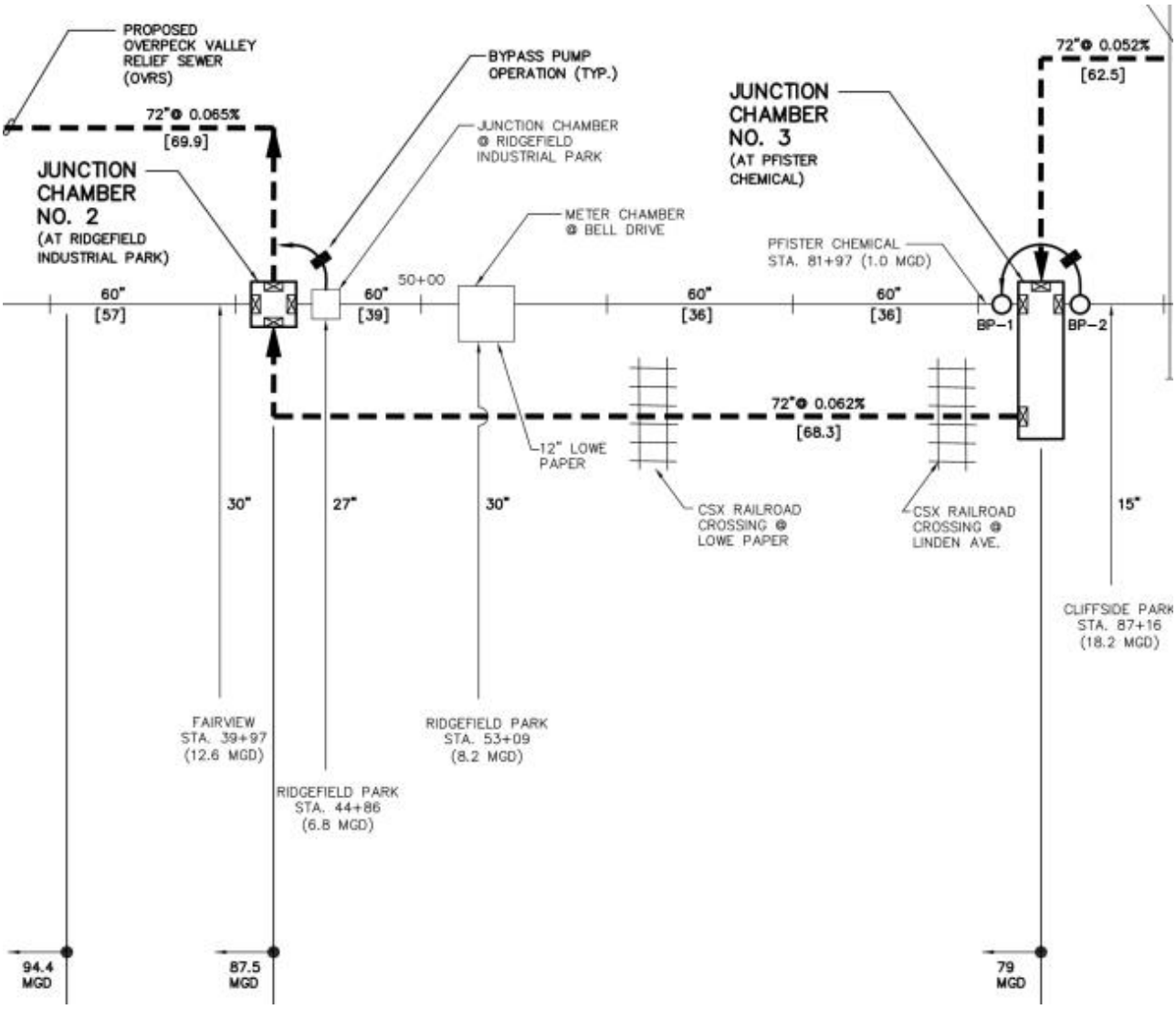

Figure 18 - F1 Section 7

Section 8 - Junction Chamber No. 2 to the Existing Junction Chamber at the BCUA Wastewater Treatment Plant

Junction Chamber No. 2 is located near the entrance driveway of the Ridgefield Industrial Park at Edgewater Avenue in Ridgefield. The chamber directly connects the existing 60″ OVTS sewer with the new 72″ OVRS sewer. In addition, the chamber allows the new OVRS sewer to cross from the east side of the existing OVTS system to the west side, which was necessary for construction. The chamber relieves the hydraulic overloading of the existing OVTS system by splitting the incoming flow between the existing and new system. A new 72″ OVRS sewer parallels the existing 60″ OVTS sewer from Junction Chamber No. 2 to Junction Chamber No. 1 and to the existing Junction Chamber at the BCUA Wastewater Treatment Plant. At the wastewater treatment plant, the new OVRS sewer connects to the existing Junction Chamber and flow by gravity to Screen Chambers No. 1 and No. 2 prior to being pumped to the plant. (See Figure 19)

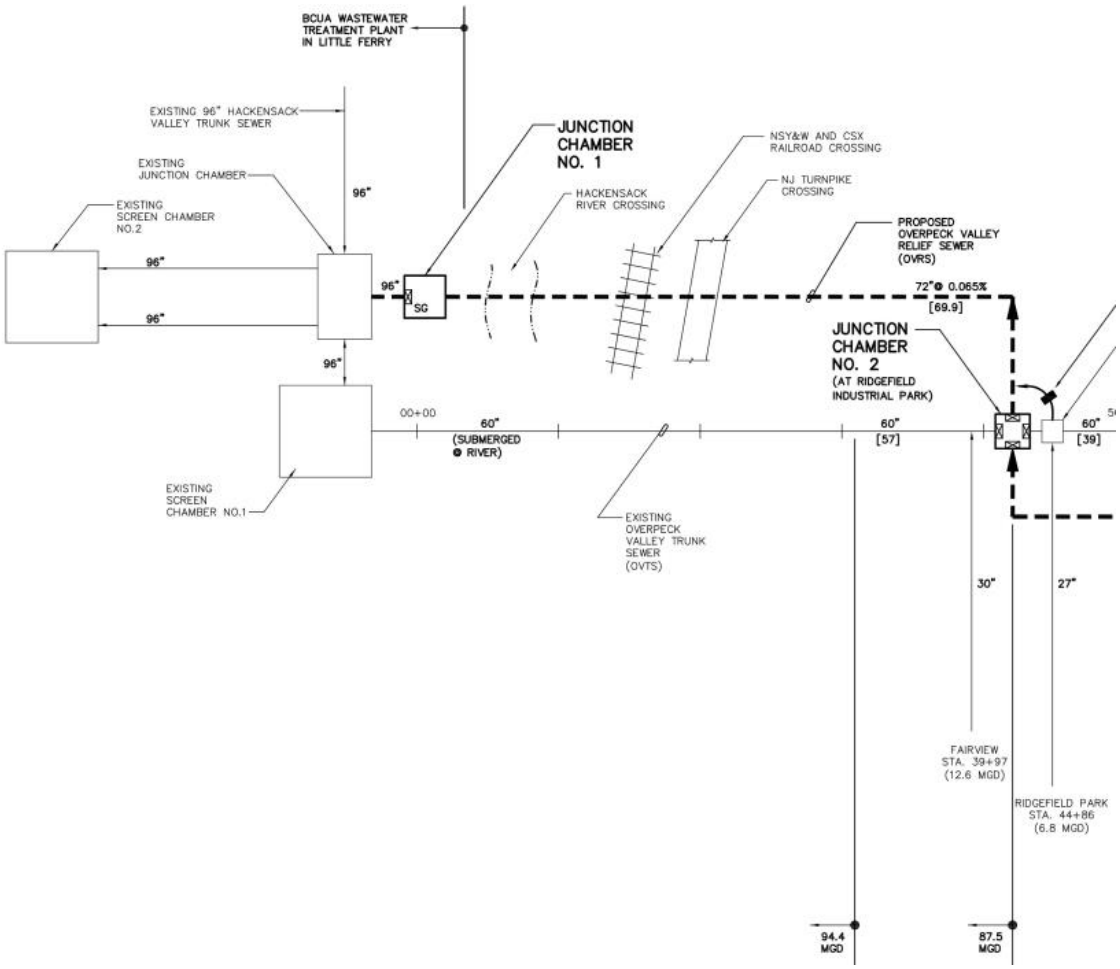

Figure 19 - F1 Section 8

The anticipated capacity of the combined Overpeck Creek Trunk and Relief Sewers was developed by the McGuire Group in a report to the BCUA. The information for Table 4-1 is taken from the design report for the Overpeck Creek Relief Sewer and shows the estimated peak flows at each Junction Chamber and

Interconnection along with the available capacities of both the older OVTS system and the new OVRS system. (The available capacity of the existing OVTS system is the full flow capacity minus the flow contributions along each stretch of sewer.) The Adjusted Peak Flow Capacity of the OVRS System have been adjusted for Time of Concentration based on previous hydraulic studies undertaken by the BCUA.

Table 4-1 – Overpeck Creek Adjusted Peak Flow Capacity

Design Flows vs. Sewer Capacity			
	Location	**Full Flow Capacity of Overpeck Trunk Sewer Only (MGD)**	**Adjusted Peak Flow Capacity of Overpeck Relief Sewer System (both sewers) (MGD)**
	Connection @ W. Forest Ave.	14.6	26.5
1	Junction Chamber No. 9	12.5	47
2	Junction Chamber No. 8	23.2	60.1
3	Junction Chamber No. 7	28.9	63.6
4	Junction Chamber No. 6	28.1	63.8
5	Junction Chamber No. 5	29.3	64.8
6	Junction Chamber No. 4	17.8	66.7
7	Junction Chamber No. 3	29.8	79
8	Junction Chamber No. 2	44	87.5

4.2 CSO Regulators and Control Facilities

In addition to the trunk and interceptor Sewers that are used to transfer the wastewater to the sewage treatment plant, flow control structures or regulators were constructed in the Village of Ridgefield Park as part of the Ridgefield Park Branch Truck Intercepting Sewer to divert all dry weather and a portion of the wet weather wastewater flows from the Village's combined sewer system into the BCUA interceptor sewer. The flow control structures also have the function of preventing surcharging of the interceptor or trunk sewer by restricting or closing the regulator gate to the interceptor and diverting flow to an outfall during periods of rainfall. Three (3) CSO Control Facilities located in Ridgefield Park are owned and operated by the BCUA. These are illustrated in Figure 20 and are labeled as R-1, R-2, and R5 respectively.

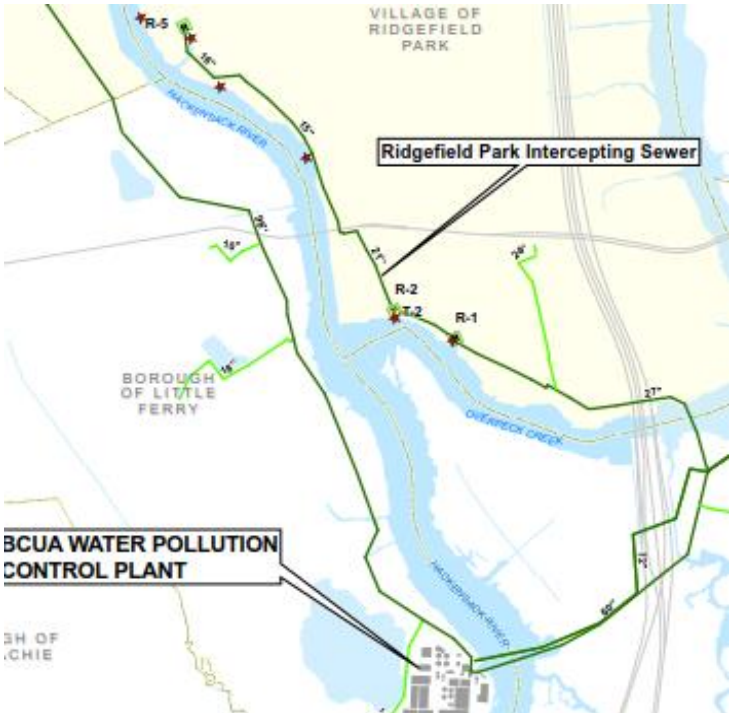

Figure 20 – BCUA CSO Regulator Chambers

Under dry weather conditions wastewater enters a diversion chamber and is diverted through an orifice into the

regulator chamber and then to the BCUA interceptor. When the wastewater flow depth in the downstream interceptor sewer rises, it causes the float mechanism in the regulator chamber to close the regulator gate. The higher the flow level in the interceptor, the more the gate closes, thereby restricting the amount of wastewater entering the interceptor. When the flow into the chamber from the combined sewer system exceeds the capacity of the regulator, the flow level in the chamber increases until it is high enough to flow over the weir as a Combined Sewer Overflow (CSO). From there CSO discharges are directed to the receiving waters by the discharge pipe. The regulator gate for Regulator 5 operates in a similar manner. The only difference is that the diversion chamber, which includes a side overflow weir is located approximately 50 feet upstream of the regulator chamber. A general schematic of the BCUA Combined Sewer Overflow Control Facility for Regulators 1 and 2 is illustrated in Figures 21 and 22.

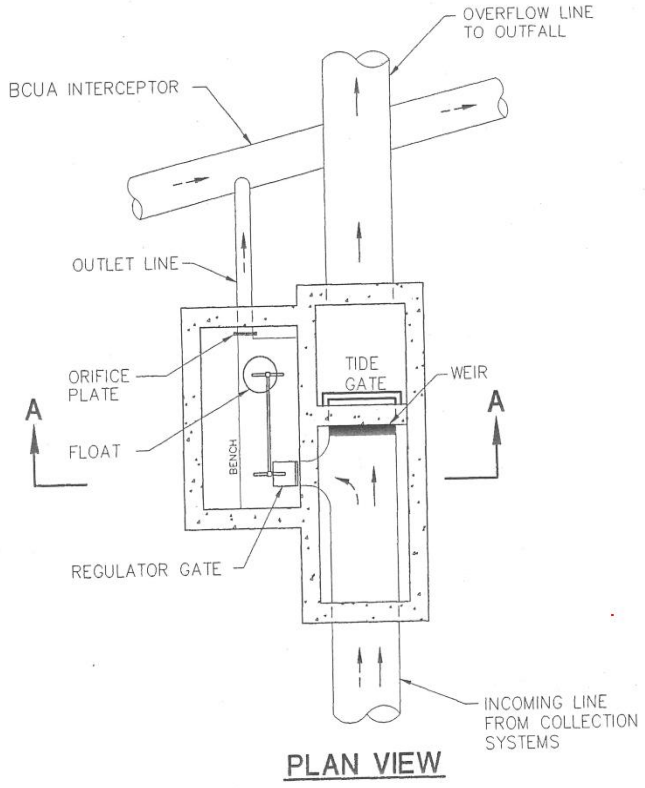

Figure 21 - CSO Regulator Plan View

CSO Control Facilities within the Borough of Fort Lee, which has several municipal pumping stations, which takes all wastewater within the municipality and pumps it into the BCUA Fort Lee Interceptor Sewer, and Hackensack City were not constructed as part of the BCUA Interceptor System are therefore owned and operated by the individual municipality.

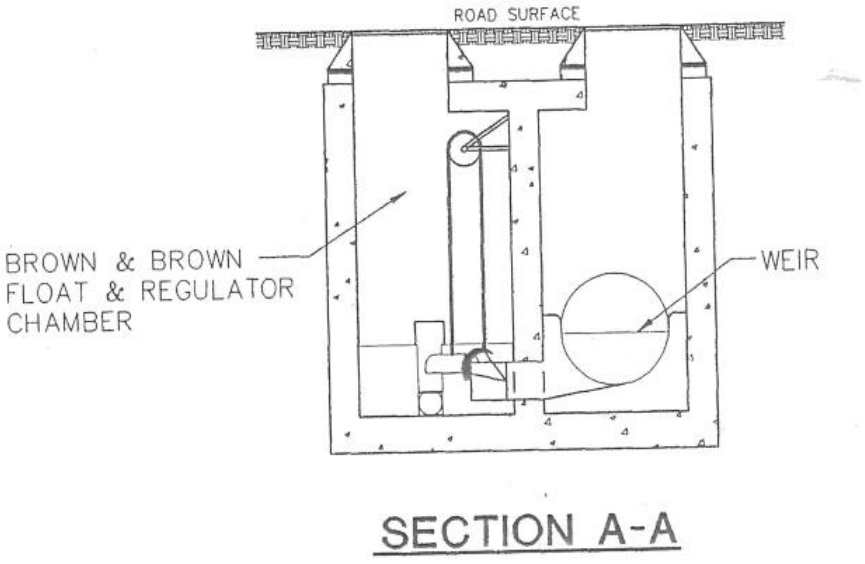

Figure 22 - CSO Regulator Section View

4.3 Recent Reports and Plans

There have been no recent reports or plans developed for the BCUA transport system outside of the Overpeck Relief Sewer that was finished in 2011.

4.4 Rainfall Monitoring Study

4.4.1 Rainfall Data Collection and Usage

Rainfall drives the both the runoff response in combined sewer areas and the rainfall dependent inflow and infiltration (RDII) response in separately sewer areas. Since these wet weather flows are critical to the performance of the collection system, having accurate rainfall data is critical to calibrating and validating the model's wet weather response. The integrated BCUA model uses two different rain gages to provide rainfall inputs to different portions of the model. The Borough of Fort Lee and the City of Hackensack models used the rain gage at Teterboro Airport as the rainfall source for their individual model calibrations/validation. Another rain gage installed on the roof of Village Hall in Ridgefield Park was used for the Ridgefield Park area and the remainder of the BCUA tributary network

A Rainfall Monitoring Study Report was prepared in September 2006 for the Village of Ridgefield Park as part of the previous NJPDES Permit to develop a statistical analysis of area rainfall. The analyses were conducted to address two objectives. The first was to develop a basis for determining the return period frequency of specific storm events that occur and the second was to determine similarities or differences between rainfall in the Ridgefield Park area, and in the Newark Area, some 14 miles southwest of the region.

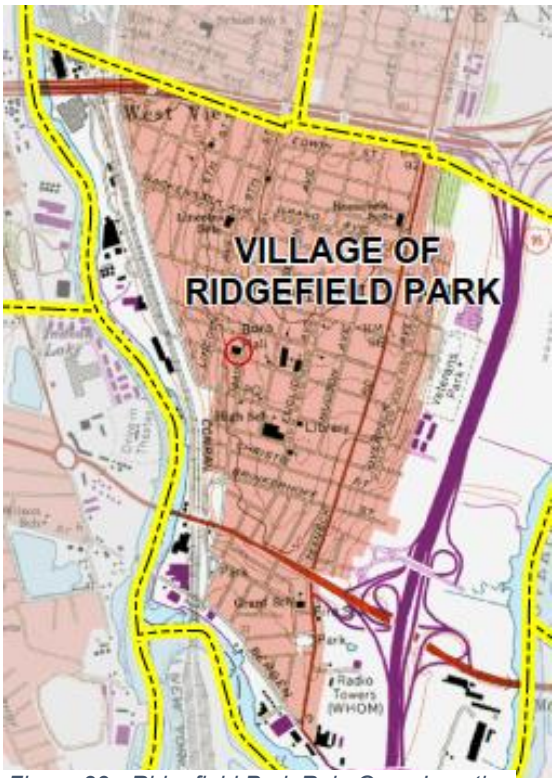

Figure 23 - Ridgefield Park Rain Gage Location

In 2017 the Village of Ridgefield Park undertook additional monitoring and modeling of segments of its combined sewer system and re-established the rain gage to collection local data during the flow monitoring period. The temporary gaging station established during the monitoring program was equipped with an ISCO Model 674-L tipping bucket logging rain gage with an 8-inch diameter tipping bucket and a Model 948 Data Transfer Unit. Rainfall intensities were measured in 0.01-inch increments and logged at ten (10) minute intervals. The unit was located on the roof of the Ridgefield Park Municipal Building, which is open and free from outside influences such as trees or areas surrounded by tall buildings. The gaging station location is illustrated in Figure 23 and had been previously (2003/4) reviewed in the field and approved by a representative of the NJDEP as part of the Village of Ridgefield Park monitoring study.

The rain gage was maintained by Mott MacDonald and used for the calibration and verification of the Ridgefield Park computer model. In addition, flow monitoring was

being conducted both in Ridgefield Park and within the BCUA Trunk Sewer simultaneously, accordingly the Ridgefield Park gage was maintained during the BCUA monitoring period so that it could be used for the calibration and verification of the BCUA InfoWorks ICM model.

A statistical analysis of long-term records of rainfall in the project area was performed in 2006 to address two different objectives. One objective was to develop a characterization of the storm events that occur in the study area. The analyses provided a basis for determining the return period frequency of specific storm events that occur and which may be monitored during the initial CSO study program. The result of this analysis is illustrated in Figure 24.

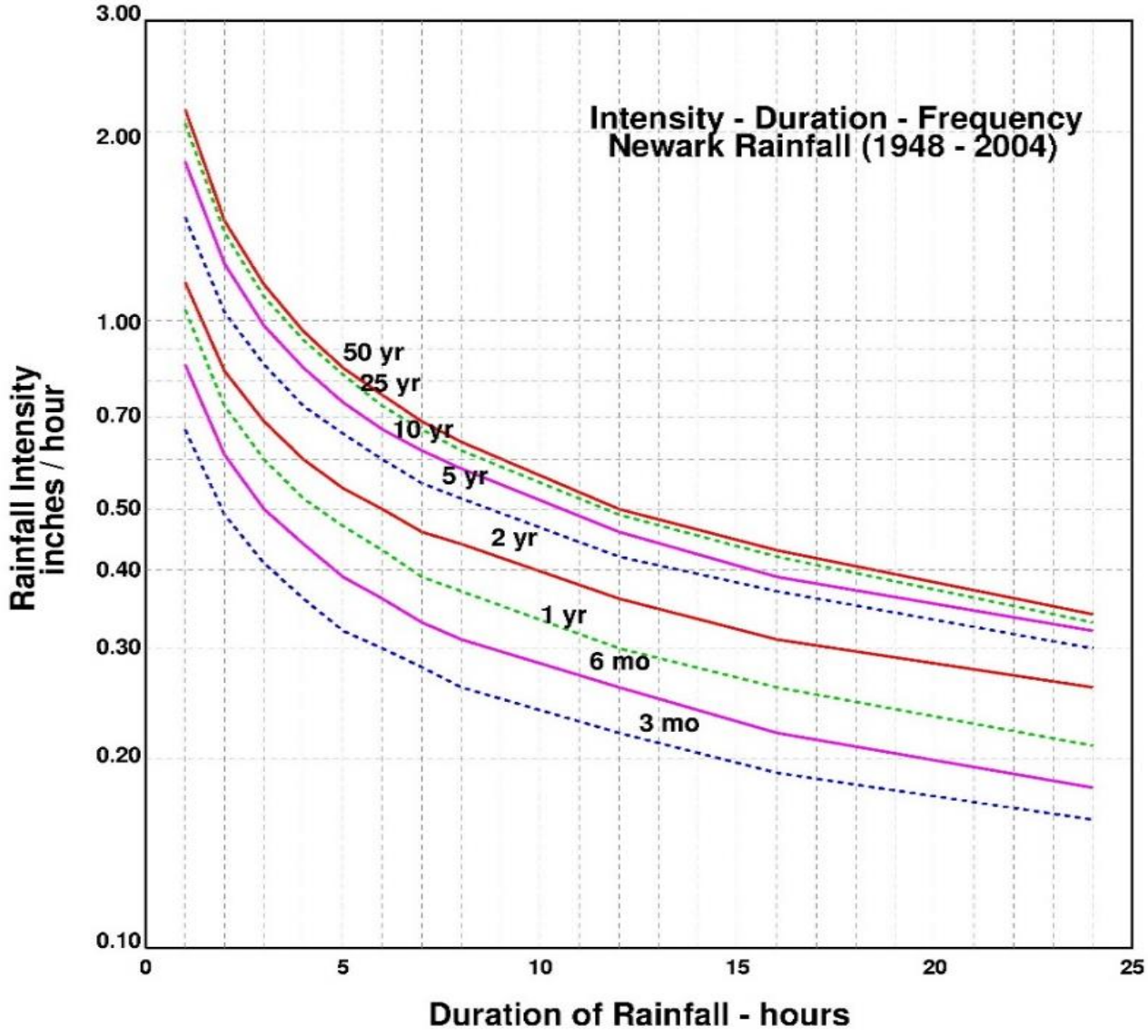

Figure 24 - 2006 Rainfall Return Periods

Rainfall represents an essential input to any collection system model as it hugely influences the wet weather flow response of a combined sewer or separate sewer collection system. Rainfall data was collected at the City Hall in Ridgefield Park throughout 2017. The rain gage was a tipping gage style rain gage collecting data at a five-minute interval. Other potential rainfall sources were investigated and considered but ultimately these different rainfall sources collected data at different time intervals or using different collection methods and the decision was made not to try and intermix such disparate sources. The Ridgefield Park rain gage was selected for use in the BCUA collection system model because it is current, and because it is consistent with the rainfall data used for the development of the Ridgefield Park combined sewer collection system model that is integrated into the BCUA collection system model. The temporary rain gage was located on the municipal building roof located at 234 main Street.

Figure 25 - Ridgefield Park Municipal Building

In addition to the temporary gage established, there are two long-term rain gages outside the study area. The NOAA gage at Newark Airport was used in the statistical evaluation of area rainfall, and during the monitoring periods. The other NOAA gage at Teterboro Airport was used to evaluate the similarities or differences between the temporary and permanent gages. While the type of gage, monitoring intervals, and specific location for these sites are out of the direct control of this program, they do enhance our ability to estimate spatial rain distribution and are the only source of long-term rainfall information for continuous simulations during historically critical periods. Accordingly, the gage at Newark will be used to supplement, as deemed necessary by experience, the temporary rain gage established under this program. All data utilized and or adjusted will be documented and substantiated in the modeling report.

The rain gage network established for this project include one permanent and one temporary rain gage stations as follows:

Teterboro Airport	NOAA Station at New Milford (Teterboro Airport) (permanent)
Village of Ridgefield Park	Temporary Rain Gage at Ridgefield Park Town Hall

4.4.2 Precipitation Data Collection

The rainfall utilized in the overall BCUA model is a combination of the rainfall data used for the individual models that constitute the systemwide model. When possible, the rainfall used for reporting is the same as that used for model calibration. The Borough of Fort Lee and the City of Hackensack have developed individual collection system models that both use rainfall collected at the Teterboro Airport. The Fort Lee collection system model was recalibrated using this rainfall data. The Hackensack collection system model was original calibrated using temporary rain gages, but the Teterboro rain gage is used for reporting purposes due to its proximity to the City. The collection system model for the Village of Ridgefield Park uses rainfall collected at a re-established rain gage located at City Hall. Although various rainfall options were investigated, the Village of Ridgefield Park rain gage is the rainfall source applied to the remainder of the municipalities tributary to BCUA's Little Ferry Treatment Plant.

4.4.3 Typical Year Analysis

Part of the Characterization of Precipitation is the development of an average or typical year. The specific impact of precipitation upon the sewer system is a function of several variables and their interactions including, but not limited to temperature, peak intensity, average intensity, duration, total volume, and antecedent rainfall. Accordingly, while precipitation volume is typically used as a measure of average rainfall it does not in and of itself provide a clear picture as to the impact of the precipitation on the sewer system.

The typical year analysis of rainfall was undertaken by Greeley and Hansen and CSM Smith for the NJ CSO Group to evaluate overall rainfall within the area. The typical year analysis was submitted as a separate report by the NJ CSO Group to the NJDEP. The analysis chose 2004 as the typical precipitation year for the permittees within northern New Jersey.

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5 Model Development

The BCUA does not own nor operate any CSO outfalls and thus under previous permits did not undertake the development of a sewer system model. The requirement under the existing permit that all CSO LTCP development be done cooperative under a regional basis required the development of a computer model to evaluate the impact of the municipal LTCPs on the regional facilities. This section describes the methodology used in the development of this computer model.

5.1 Modeling Framework

The BCUA collection system model was built and simulated using the InfoWorks ICM collection system modeling software. InfoWorks ICM is a sophisticated, fully dynamic collection system model that can characterize a broad spectrum of hydrologic and hydraulic conditions. It is fully capable of handling any of the complex system influences such as backwater effects, flow reversal, surcharging and tidal influences. The BCUA collection system model was built using a combination of independently built and calibrated models for the combined sewer communities (Hackensack and Ridgefield Park) together with modeling to represent the BCUA trunk sewers, plant infrastructure, and contributions to that infrastructure from the separate sewer communities. The Fort Lee InfoWorks model was not available at the time of model development and will be integrated into the model in the future. A subset of the permanent flow meters maintained by BCUA for billing purposes, including two for Fort Lee, along with the temporary flow meters described in Section 3 that were installed along the BCUA trunk system were used for model development and calibration/validation.

The critical infrastructure included in the BCUA collection system model includes the BCUA trunk network that conveys flows to the WWTP as described in Section 3. These pieces of infrastructure define the flow capacity of the trunk system as well as any backflow conditions that may exist based on the existing capacity of the WWTP.

The tributary sanitary sewer inputs from separate sewered municipalities were not developed in the separate municipal combined sewer system models developed by Fort Lee, Hackensack, and Ridgefield Park, however they are included in the BCUA model. Of the 150 billing flow meters maintained by BCUA, the clear majority are measuring sanitary sewer inputs to the BCUA trunk network as flow enters the BCUA Trunk Sewer System. As previously noted a review of the 150 billing flow meter data illustrated that 85% of the total flow in the BCUA WPCF is measured by 45 individual meters. Accordingly, Mott MacDonald used metered flow from these 45 meters and grouped the flow from the remaining 105 meters according to general locations along the trunk sewer. The input from the 105 metering sites were modeled by including a small portion of the pipe network from each drainage basin including the locations of these meters. The permanent flow meters were then used with the temporary trunk flow meters to realistically simulate the flows entering the BCUA trunk network.

Although InfoWorks ICM is the official collection system model software used for this project, the InfoWorks model was exported into the PC-SWMM modeling software to take advantage of some autocalibration features that are unique to PC-SWMM to facilitate model calibration and validation. After the auto-calibration was completed, the updated calibration variables were brought back in InfoWorks ICM for inclusion in the final model.

5.2 Dry Weather Flows

The Environmental Protection Agency's (EPA) Sanitary Sewer Overflow Analysis and Planning (SSOAP) analysis tool was used to calculate the Dry Weather Flow (DWF) components from the flow meter data. The SSOAP tool uses flow monitoring and rainfall data to characterize a collection system's DWF and Wet Weather Flow (WWF) responses. SSOAP identifies dry weather days based on defined rainfall criteria which typical includes a defined time period with no measured rainfall before DWF conditions are assumed to have started. In addition, a DWF day is only included if all 24-hours of that day are rainfall free. Once the DWF days are selected, the measured DWF was separated into its BSF (Base Sanitary Flow) and GWI (Ground Water Infiltration) components by applying the Stephens-Schutzbach equation (Determining Base Infiltration in Sewers, ADS, 2008, available for download at http://www.adsenv.com/resources/white-papers). Many empirical methods are available for dividing the DWF into its BSF and GWI components, but the Stephens-Schutzbach method has been thoroughly tested and proven reliable. The equation is shown below. Note that MDF = Minimum Daily DWF and ADF = Average Daily DWF.

$$GWI = 0.4\ (MDF)/[1 - 0.6\left(\frac{MDF}{ADF}\right)^{ADF^{0.7}}]$$

SF (sanitary flow) represents wastewater conveyed from residential, commercial and industrial sources that typically has a repeating diurnal pattern. The BSF in residential and some commercial sources is normally population driven, while industrial sources often have unique patterns based upon what industrial processes are being used and the hours of production. The BCUA tributary area is predominantly residential and commercial, but does have some industrial areas as well. For the BCUA model, the BSF flows were allocated on a population basis unless there was clear evidence of significant industrial flow contributions from the measured flow meter data. The population for each individual subcatchment was computed via a GIS analysis which intersected 2010 US Census block data with the subcatchment polygon boundary. The 2010 US Census data was used because it is the latest official population data available, although Census population estimates are available. Dimensionless diurnal patterns were calculated to reflect how BSFs vary throughout the day according to a stable and repeatable pattern. Separate patterns were developed for weekdays and weekend days to reflect that weekdays and weekends typically have distinctly different patterns. The weekday and weekend diurnal patterns were calculated based on the following procedure:

- Calculate the average weekday and weekend hourly DWFs from the days identified from the SSOAP analysis.
- Estimate the GWI by applying the Stephens-Schutzbach equation.
- Subtract the hourly GWI from each hourly dry weather flow to determine the hourly BSF.
- Divide the hourly BSF by the daily average BSF to calculate the hourly BSF factors.

The two diurnal flow patterns as illustrated in Figure 26 were imported into InfoWorks ICM and applied to the subcatchments, as appropriate. The model automatically selects the appropriate diurnal pattern to use depending on the calendar day of the model simulation.

Dry weather GWI is typically a slowly varying continuous infiltration into both combined and sanitary sewer pipes. This continuous infiltration typically occurs through defects in the pipes or manholes in the collection

system. Higher levels of GWI generally correspond to times of year when groundwater levels are higher (often late winter/early spring). The lowest GWI levels typically occur in late summer/early fall when

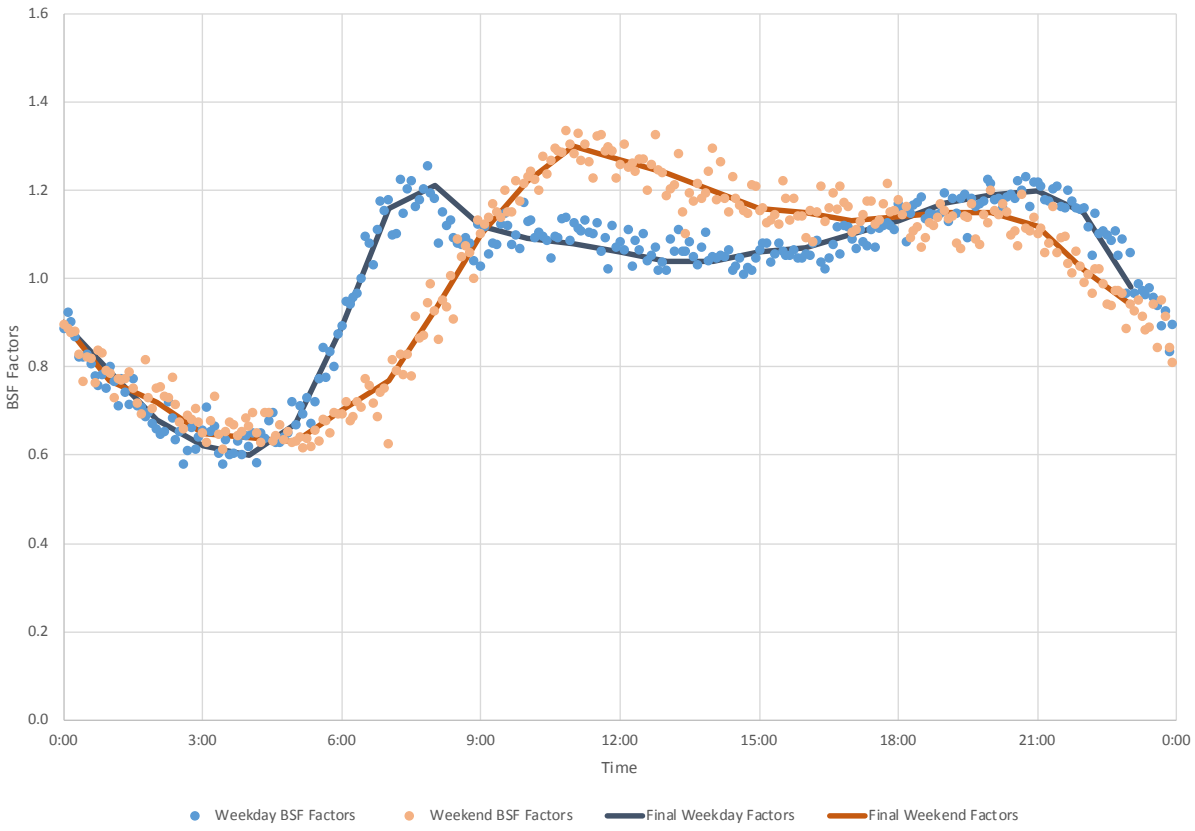

Figure 26 - Weekday and Weekend Diurnal DWF Factors

groundwater levels are lowest. If GWI levels are quite stable throughout the year a single, fixed GWI is applied to all time periods. However, if significantly varying GWI influence is observed in the flow meter data, monthly varying GWI factors can be applied to better match the flow meter data. Because GWI enters the sewer system primarily through public and private sewer system defects that are distributed throughout the collection system, it is proportionally distributed in the model based on inch-miles of pipe. The logic is that groundwater enters the collection system proportional to the pipe cross sectional area. The modeled assumption is that greater pipe surface area will result in greater GWI entering the collection system

5.3 Wet Weather Flows and Water Quality Calibration

Sanitary sewers are designed to convey sewage flows downstream for treatment while limiting the entry of wet weather flows into the collection system. These wet weather flows can be reduced but not eliminated and are dependent on many different variables such as:

- Age and condition of the collection system
- Construction practices at the time of installation
- Prevalence of direct or indirect stormwater connections to the sanitary system

- Operation and maintenance of the system
- Antecedent moisture conditions (the saturation level of the soil around the sewers)
- Groundwater elevation

Because these many influencing factors are difficult to quantify, a simplified modeling approach must be used. The most industry standard approach and the one applied to the BCUA collection system model is the RTK Method. The RTK method attempts to simplify the complex wet weather response by using three triangular synthetic hydrographs that are summed together. These three hydrographs include:

- Fast Response (R1, T1, K1) – rapid inflow from direct, unknown storm connections
- Moderate Response (R2, T2, K2) – inflow or infiltration from property lateral connections and the laterals themselves
- Slow Response (R3, T3, K3) – infiltration from cracks or other defects in public sewers or private laterals

Each of these hydrographs is defined by the three variables below and as shown in Figure 27:

- “R” is the fraction of precipitation that enters the collection system, referred to as “% capture.”
- “T” is the time to peak of the hydrograph.
- “K” is the ratio of the hydrograph recession time to the time to peak

Because of the diversity of the influencing variables, the wet weather response into sanitary sewers can vary markedly throughout the year. As a result, the model allows for the RTK variables to be changed monthly so the model can better reflect the highly variable sewer response.

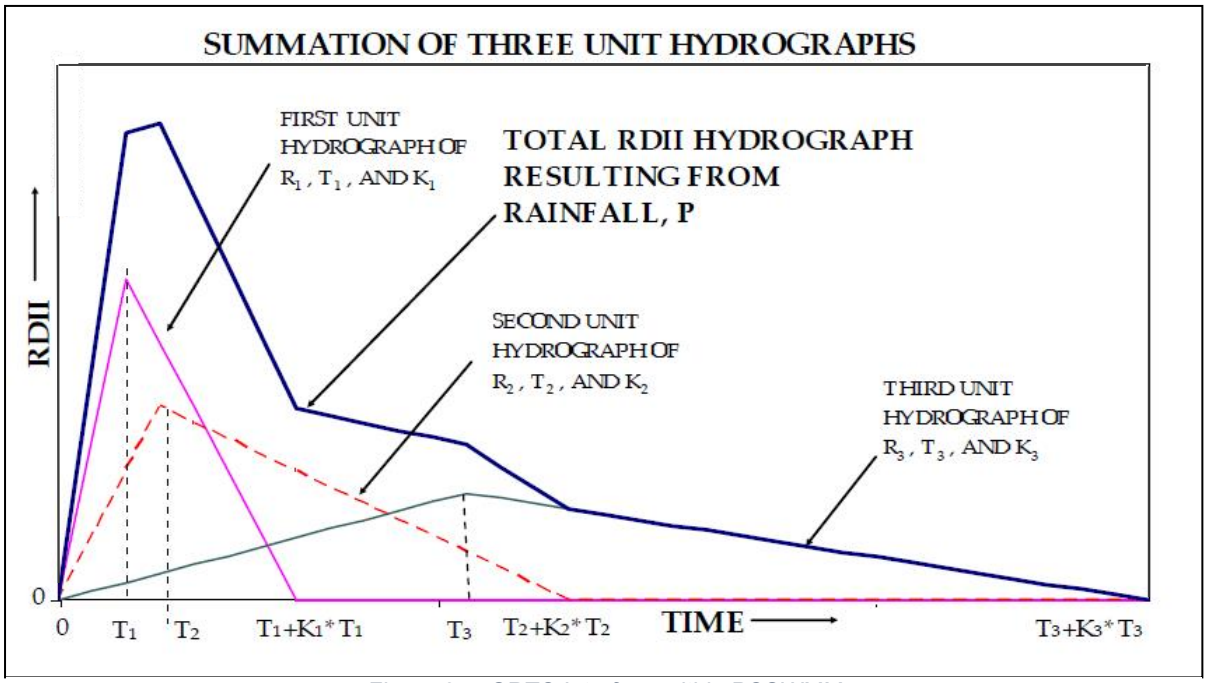

Figure 27 - SRTC Interface within PCSWMM

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6 Model Calibration and Verification

Model calibration generally consists of changing the model variables of the sewer network and subcatchments to achieve an acceptable agreement between model predicted and observed flows, depths, and volumes from the flow meters. Historically this task has involved making manual adjustments to individual variables, simulating the model, and evaluating whether the model to flow meter match improved or not. This manual process can be tedious and very time-consuming to make the model match observed results. Increasingly common in collection system model calibration is using an auto-calibrator, or a tool the speeds up the calibration process by finding the best model-to-meter fit without the time investment of manual calibration. InfoWorks ICM does not have a built-in auto-calibrator, so for the BCUA collection system model, sub-models were “clipped” from the original InfoWorks ICM model to be imported into the PC-SWMM software. The PCSWMM software includes an auto-calibration capability to aid model calibration by allowing for rapid adjustment of the model variables to more closely match the observed hydrographs over their full response.

The autocalibration capabilities within PCSWMM are referred to as Sensitivity-Based Radio Tuning Calibration (SRTC). Not only does this tool allow for adjusting different variables to investigate their impact on the overall model response, but it allows the user to define uncertainty bands for the variables to make the results more physically realistic. The SRTC interface within PCSWMM is shown in Figure 28. Variables that are more poorly known can have wide uncertainty band applied and more defined variables can have a narrower band applied. This autocalibration tool was used to calibrate the wet weather RTK response from the sanitary sewer communities that connect to the BCUA trunk system areas.

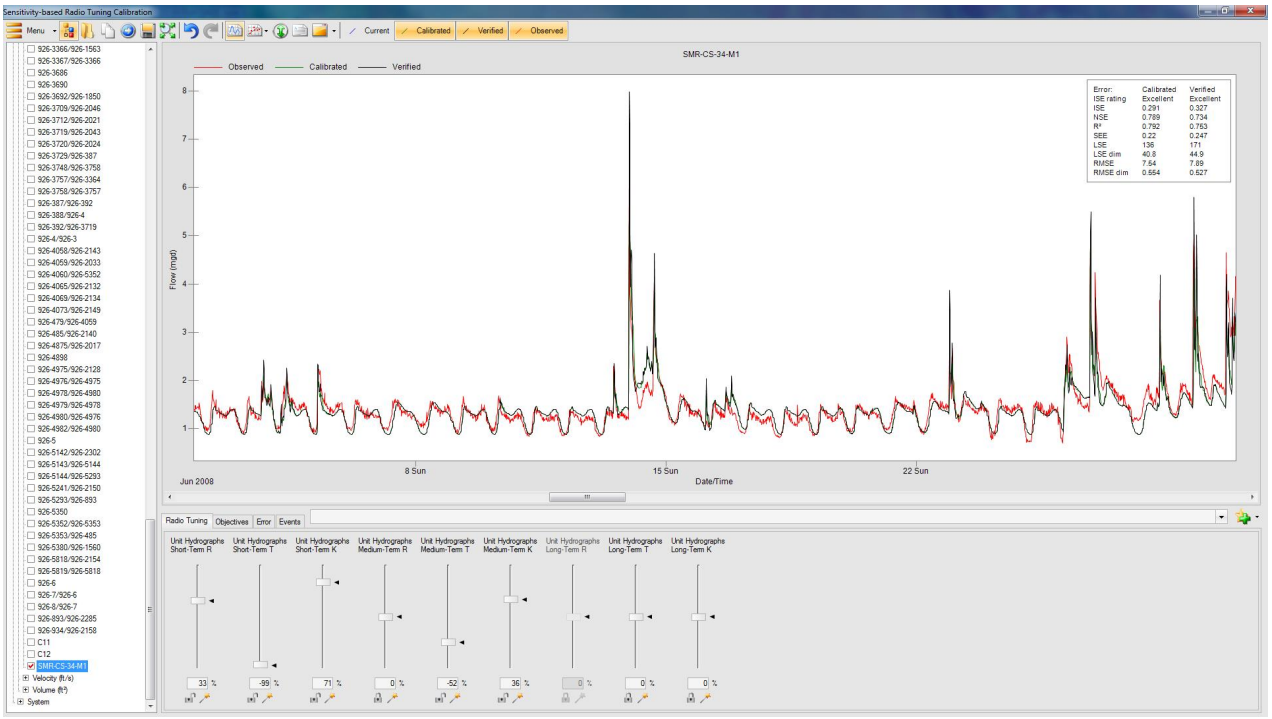


Figure 28 - SRTC Interface with PCSWMM

The SRTC tool allows the user to manually move a “slider” for an individual variable to evaluate how changing the value of that variable is estimated to impact the overall model response. In addition, the user can simply

click a “best fit” button and PCSWMM will adjust the variable to best match the calibration objective (overall response, priority on peak flow, priority on volume, etc.). In addition to greatly speeding the model calibration effort, using the SRTC tool prevents the common model calibration issue of overfit.

Calibration overfit refers to a situation where the model has been so customized to produce good results for specific calibration storms that the model’s general performance actually decreases. The reality of this problem is why model validation is an important secondary step after model calibration is complete. Model validation tests the model’s performance against an independent data set not used for model calibration. Essentially, model validation represents the model’s expected performance under any arbitrary conditions. A model’s validation performance is the truest measure of its “generally expected” performance. The greater the gap between a model’s calibration performance and its validation indicates a greater degree of model overfit. If a model’s calibration and validation performance are very similar or indistinguishable, it indicates that the model suffers from little to no overfit.

The issue of model overfit is largely overcome through the SRTC tool because it optimizes the overall match between the flow meter data and the model results, by definition it is optimizing to multiple events. Because the SRTC tool was applied for all calibration/validation storm events used for this project, the model’s calibration and validation performance could be optimized without overfitting to any particular storm.

6.1 Calibration Criteria

The most common way to evaluate collection system model performance is through the application of individual storm event numerical criteria. This approach isolates individual storm events with distinct start and end times from a continuous model simulation and evaluates metrics such as peak flow, overall volume, and peak depth against a numerical standard. The most widely used standard of this kind comes from the Wastewater Planning Users Group (WaPUG) Code of Practice for the Hydraulic Modeling of Sewer Systems. Table 6-1 summarizes the numerical calibration/validation criteria that are part of this standard.

Table 6-1 – WaPUG Model Calibration/Validation Criteria

Category	Dry weather flow	Wet weather flow
Peak flow	±10%	+25% to -15%
Volume	±10%	+20% to -10%
Unsurcharged depth	±4 inches	±4 inches
Surcharged depth	N/A	+20 inches to -4 inches
Time of peaks	Within 1 hour	Similar

Additional non-numeric criteria include the following:

- Known flooding experienced during flow monitoring should be reasonably reproduced by the model.
- The location, frequency, and severity of historical flooding locations should be reasonably reproduced by the model.
- The model should accurately reproduce the activation frequency and overall discharge volume of known significant CSOs and SSOs.

For dry and wet weather events, WaPUG recommends that a sufficient number of time periods within the flow meter data are selected to reasonably calibrate and validate the results. A single continuous flow record should be used where there is significant rainfall induced variation in inflow and infiltration. WaPUG also recommends that for at least two-thirds of the rain events selected, the measured results should match model results within WaPUG Standards for all flow meter sites with suitable data.

It should be noted that in addition to individual storm event calibration/validation statistics, an alternative method of evaluating model performance does exist. Continuous calibration compares the entire time series of the flow meter and model results rather than just using event statistics. In continuous calibration, a single value is used to indicate the level of agreement between the flow meter and model results. The most common metric utilized is the Nash-Sutcliffe model efficiency coefficient. This coefficient varies from 1 (perfect model and meter data fit) to -∞, with 0 meaning the model predictions are as accurate as the mean of the measured data. Although Nash-Sutcliffe coefficient results are not included in this report, they were reviewed during the calibration/validation process. For this report, conventional WaPUG criteria was used because they remain the industry standard for model calibration/validation.

6.2 Dry Weather Calibrations

Dry weather flow was distributed to the model as described in Section 4.2. The BSF diurnal pattern was assigned to all sub-catchments within a meter basin area with BSF flows allocated based on population fraction. Similarly, GWI flows were allocated based on pipe inch-mile fraction within the metered basin. Monthly varying GWI factors were assigned in metered basins where highly variable GWI responses were identified. Comparisons between predicted and observed DWF were quantified in tabular form using the criteria listed in Table 6-1 and visually through observed versus model predicted plots at each flow monitoring location. The results of the DWF calibrations are included in Section 8.

Extended DWF periods were identified during both the Spring and Fall of the 2017 flow monitoring period to use for DWF calibration. Comparing the model's DWF results to an extended dry weather period in the flow monitoring period is a more robust comparison than simply comparing selected DWF days pulled from the flow monitoring record. Two continuous DWF weeks were identified in April and September from the 2017 data. Each of these weeks consisted of at least a six-day continuous dry weather period that also include different seasons. For these different periods, the DWF calibration statistics from Table 6-2 were calculated. Table 6-2 provides an example of the calculation of these DWF statistics and is representative of the same tables computed for each flow meter that are provided in Section 8.

The total volume over the entire DWF week was used for the volume comparison while each day's peak flows were averaged together for the peak flow comparison. Because the DWF weeks are selected from different seasons throughout the year, they can reveal any seasonal GWI variations. Although BSF is virtually always consistent regardless of season, the GWI can vary markedly season to season. This high variability can make it difficult to provide a consistently good DWF model response. However, results from the BCUA flow metering revealed relatively consistent GWI responses throughout the year, so individual monthly GWI variation was not required. The DWF calibration results generally indicate that the model provides an acceptable match to the measured DWF data.

Table 6-2 - Model DWF Calibration/Validation Results

DWF calibration statistics – September 2017			
Category	Simulated	Measured	% Error
Peak Flow (Avg)	1.32	1.48	-10.7%
Volume	8.22	8.70	-5.5%
Depth (Avg)	3.18	2.94	8.3%

DWF daily peak flows (MGD)		
DWF day	Simulated	Measured
9/24/17	1.37	1.50
9/25/17	1.37	1.59
9/26/17	1.30	1.47
9/27/17	1.30	1.42
9/28/17	1.30	1.39
9/29/17	1.30	1.42
9/30/17	1.30	1.58

6.3 Wet Weather Calibration

Following completion of the DWF calibration, wet weather calibration was initiated. The sanitary sewer areas were calibrated according to the variables and approaches described in Section 5. The SRTC tool within PCSWMM was applied to the RTK variables in the sanitary sewer areas as previously described. The only other variable in the SRTC analysis was the contributing area. It is typical difficult to determine the portion of a potential drainage area that is contributing wet weather flows to the sanitary sewer through inflow and infiltration. Allowing the SRTC to include contributing area acknowledged how approximately this value is known, and markedly improved the overall wet weather calibration. In addition to the calibration criteria in Table 6-1, the following wet weather calibration goals were also used:

- A regression line with an R^2 value close to 1.00 indicating a goodness-of-fit between the modeled and observed storm volumes and peak flows
- An intercept of the regression line close to zero (0) indicating that the modeled event volumes and peak flow rates were not biased with respect to the observed volumes and peak flows

As discussed above as part of the calibration and validation process the continuous record of flow meter data was utilized. For the reporting of individual event statistics, a total of 15 storm events were identified (10 for calibration and 5 for validation). These event statistics as well as the WWF peak flow versus peak flow and volume versus volume plots are included in Section 7. Table 6-3 includes a breakdown of the calibration and validation storms used including various attributes of the storm events. The overall goal was to get storms that represented a wide variety of durations, peak intensities, total rainfalls and that were distributed through different seasons. Table 6-4 includes an estimate of typical return period for storms of similar rainfall volume and peak rainfall intensity. Return periods for volume fell between 0.2 – 15.9 months, while return periods for peak rainfall intensity ranged from 0.1 – 28.1 months.

Overall WWF calibration and validation was completed with variable success with some locations calibrating successfully and others not fully meeting the calibration criteria. A summary of the WWF calibration performance is included in Table 6-5. The results are characterized as the number of storms that fall into various categories of compliance with the calibration/validation criteria listed in Table 6-1.

Table 6-3 - Calibration / Validation Storm Events

Classification	Start Date/Time	Rainfall (in)	Duration (hr)	Peak Intensity (in/hr)
Calibration	03/31/17 0:30	1.50	29.25	0.19
Calibration	04/20/17 5:45	0.12	1.75	0.10
Calibration	04/21/17 0:15	0.39	7.33	0.23
Validation	05/05/17 3:50	2.87	22.50	1.18
Reference	05/13/17 2:30	1.67	37.75	0.19
Calibration	05/25/17 4:25	0.73	25.42	0.11
Calibration	05/31/17 20:55	0.24	0.75	0.24
Validation	06/16/17 17:10	0.10	0.58	0.10
Validation	06/17/17 11:15	0.35	2.25	0.26
Calibration	06/23/17 21:35	1.16	10.08	0.59
Calibration	07/07/17 8:00	0.89	24.17	0.60
Calibration	07/22/17 23:00	0.41	6.08	0.25
Calibration	07/24/17 0:05	0.81	12.17	0.28
Validation	08/07/17 10:15	0.89	10.50	0.31
Calibration	08/15/17 2:45	0.12	1.17	0.11
Validation	08/18/17 7:45	1.42	12.58	1.31

Table 6-4 – Storm Event Return Period Analysis

Date		Rainfall (inches)	Return Period Months	Peak hourly (in/hr.)	Return Period Months
3/31/2017	Calibration	1.5	2.3	0.19	0.3
4/20/2017	Calibration	0.12	0.2	0.1	0.1
4/21/2017	Calibration	0.39	0.3	0.23	0.4
5/5/2017	Reference	2.87	**15.9**	1.18	21.4
5/25/2017	Calibration	0.73	0.6	0.11	0.1
5/31/2017	Calibration	0.24	0.2	0.24	0.4
6/23/2017	Calibration	1.16	1.3	0.59	2.6
7/7/2017	Calibration	0.89	0.8	0.6	2.8
7/22/2017	Calibration	0.41	0.3	0.25	0.4
7/24/2017	Calibration	0.81	0.7	0.28	0.5
8/15/2017	Calibration	0.12	0.2	0.11	0.1
5/13/2017	Validation	1.67	3.1	0.19	0.3
6/16/2017	Validation	0.1	NA	0.1	0.1
6/17/2017	Validation	0.35	0.3	0.26	0.4
8/7/2017	Validation	0.89	0.8	0.31	0.6
8/18/2017	Validation	1.42	2.1	1.31	**28.1**

Table 6-5 – 2017 WWF Calibration Performance Summary

Meter	3 of 3 criteria	2 of 3 criteria	1 of 3 criteria	0 of 3 criteria
Temp Meter 01	0	0	5	5
Temp Meter 02	1	2	6	0
Temp Meter 03+04	10	0	0	0
Temp Meter 05	6	3	1	0
Temp Meter 06	9	1	0	0
Temp Meter 07	7	2	1	0
Temp Meter 08	0	7	3	0
Temp Meter 09+10	4	5	1	0
Totals	**37**	**20**	**17**	**5**
Totals (%)	**46.8%**	**25.3%**	**21.5%**	**6.3%**

6.4 Model Verification

Five storm events were selected for model validation as listed in Table 6-3. As for the calibration storm events, the selection of validation storms was get a wide sample of storm types and conditions that extended throughout the range of the flow monitoring period. The results of model validation are shown of the below in Table 6-6.

Table 6-6 - 2017 WWF Validation Performance Summary

Meter	3 of 3 criteria	2 of 3 criteria	1 of 3 criteria	0 of 3 criteria
Temp Meter 01	0	0	2	3
Temp Meter 02	1	0	2	0
Temp Meter 03+04	4	1	0	0
Temp Meter 05	3	2	0	0
Temp Meter 06	4	1	0	0
Temp Meter 07	3	2	0	0
Temp Meter 08	0	3	2	0
Temp Meter 09+10	3	2	0	0
Totals	**18**	**11**	**6**	**3**
Totals (%)	**47.4%**	**28.9%**	**15.8%**	**7.9%**

6.5 Model Assessment

The goal of the calibration and validation process for any collection system model is to build sufficient confidence in the model that it can be used as a reliable tool to describe current system performance as well as evaluate potential system improvements. Overall the BCUA collection system was successfully calibrated and validated with some individual exceptions where even with the benefit of the STRC tool a reliable match between the model results and flow meter data could not be achieved. However, these exceptions were generally rare, only in isolated area and could potentially have been due to flow meter related issues or occurrences when the modeled rainfall did not appear to be representative of what was measured by the flow meters. Specific notes on the BCUA model calibration and validation are included below:

- **Temp Meter 01**: This meter is located a short distance upstream of the WCPF and is influenced by backwater conditions by the WCPF as well as continuous negative flows due to adversely sloped pipes. Although the model did replicate the negative flow conditions, it had difficulty replicating the peak flows during storm events when flows switch to the positive direction.
- **Temp Meter 02**: This meter is in the same structure as Temp Meter 01 and is similarly influenced by the WCPF. The model generally matched well to the overall hydrograph trends, however the model had difficulty matching the measured peak flows. Various options were investigated to improve the overall match to the flow meter data. The results reported in Appendix B were the best that could be achieved.
- **Temp Meters 03 + 04**: These meters were combined to evaluate the overall model response because they were located along parallel interceptors with several cross connections. It was determined that the sum of these meters was an acceptable approach because they are side-by-side and convey flow downstream to the same location. A result of this approach is that peak flows were not included in the summation comparison. Nearly all calibration and validation storms met criteria for peak flows and volumes.
- **Temp Meter 08**: This flow meter exhibited a peak depth the model could not match. As with any calibration /validation issue identified, the issue was investigated for possible resolution. Most of the calibration/validation storms met criteria for peak flows and volumes. With no obvious solution available for the depth issue, it was left as is.
- **Temp Meters 09 +10**: These meters were evaluated in the same manner as Temp Meters 03 + 04.

As shown Tables 6-5 and 6-6, the BCUA model met calibration criteria for nearly half of all calibration and validation storm events. Greater than 70% of calibration and validation events also had only a single criterion fail to meet criteria. These results in addition to the overall trending of the hydrographs lead to the conclusion that the BCUA model is acceptably calibrated and is sufficient for use in evaluating system improvement alternatives.

7 Consideration of Sensitive Areas

The BCUA owns and operates the transport and treatment facilities that collect and treat wastewater flows from the forty-seven (47) municipal sanitary and combined sewer systems within their District. BCUA does own and operate two CSO Control Facilities in the Village of Ridgefield Park that divert wastewater flows to the BCUA Branch Trunk Sewer, but does not own nor operate any CSO Outfalls. All CSO Outfalls within the BCUA Service District where constructed by, and are owned and operated by the individual municipalities. The consideration of sensitive areas is meant to look at the potential impacts of CSO discharges in and around CSO Outfalls. Accordingly, the consideration of sensitive areas will be conducted and reported upon by the individual municipality (Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park) in their individual Sewer System Characterization Report, which are incorporated herein by reference.

8 CSO Analysis and Extended Period Simulation

The BCUA does not own nor operate any CSO Outfalls and thus has no CSO discharges. All three CSO communities within the BCUA District are undertaking their own Characterization Study Characterization Study and model development for analysis of CSO discharges. Accordingly, information on the extended period simulation using the typical year of 2004 is located within the individual Sewer System Characterization Reports as prepared by the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park.

Sewer systems are dynamic in nature and thus it is anticipated that a hydraulic model will not be able to perfectly simulate dry and wet weather flows under all conditions. For purposes of this project the BCUA CSO Group has determined that it would use the Wastewater Planning Users Group (WaPUG) model calibration criteria to evaluate how well the individual models are mimicking flow data collected during the project. The WaPUG calibration criteria general notes that for both dry and wet weather calibrations the shape of modeled and metered curves should be similar for flow and depth, and that the timing of the peaks, troughs, and recessions of the modeled and metered curves should be similar for flow and depth. In addition, the following allowances have been established in terms of how well the model agrees with peak flow and volumes during both dry and wet weather as follows:

Parameter	Dry Weather Calibration	Wet Weather Calibration
Peak flow rate	-10 to +10% of measured	-15 to +25% of measured
Flow volume	-10 to +10% of measured	-10 to +25% of measured

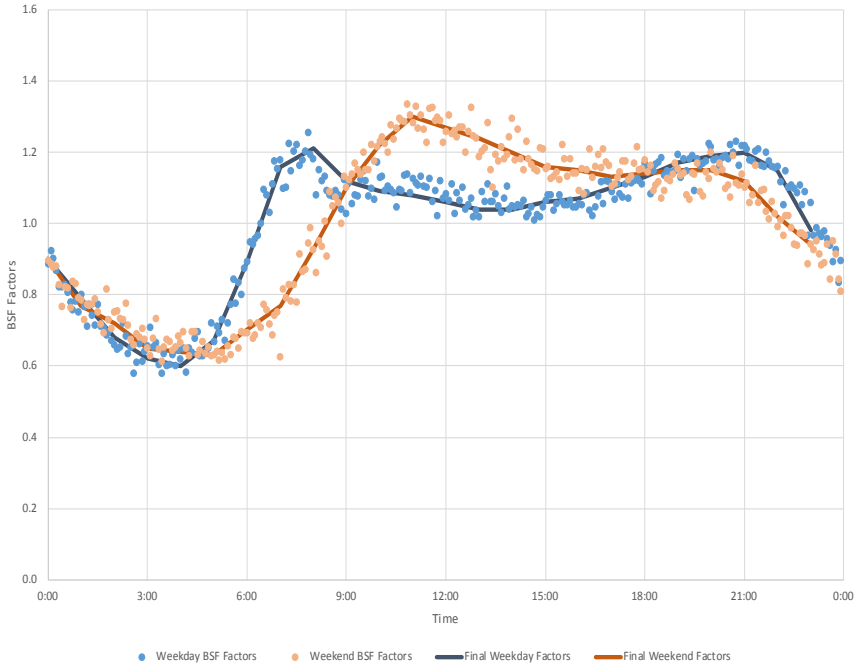
Graphic representations of the dry and wet weather period calibration/verification comparison to the above referenced criteria are illustrated in subsequent sections.

8.1 Dry Weather Analysis

SF (sanitary flow) represents wastewater conveyed from residential, commercial and industrial sources that typically has a repeating diurnal pattern. The BSF in residential and some commercial sources is normally population driven, while industrial sources often have unique patterns based upon what industrial processes are being used and the hours of production. The BCUA tributary area is predominantly residential and commercial, but does have some industrial areas as well. Separate patterns were developed for weekdays and weekend days to reflect that weekdays and weekends typically have distinctly different patterns. The weekday and weekend diurnal patterns were calculated based on the following procedure:

- Calculate the average weekday and weekend hourly DWFs from the days identified from the SSOAP analysis.
- Estimate the GWI by applying the Stephens-Schutzbach equation.
- Subtract the hourly GWI from each hourly dry weather flow to determine the hourly BSF.
- Divide the hourly BSF by the daily average BSF to calculate the hourly BSF factors.

The two diurnal flow patterns as illustrated below were imported into InfoWorks ICM and applied to the subcatchments, as appropriate. The model automatically selects the appropriate diurnal pattern to use depending on the calendar day of the model simulation.



8.2 Dry Weather Calibration Results

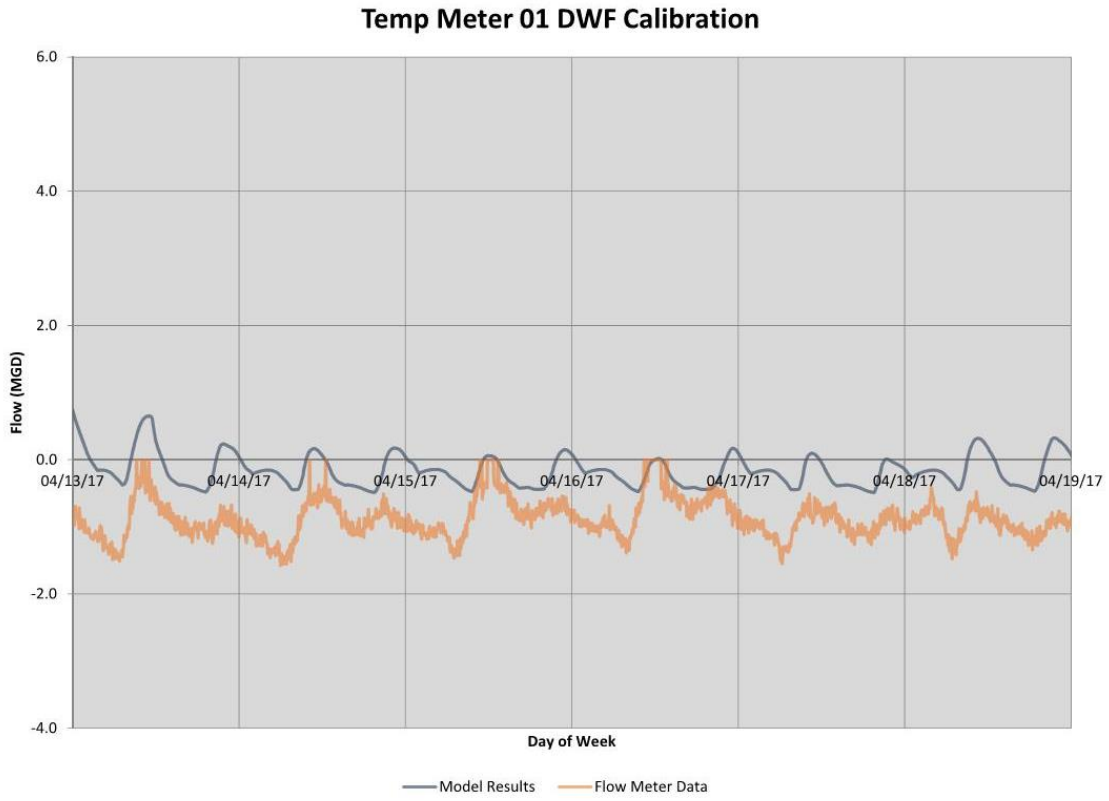
Monitoring of flows was conducted during the spring and summer of 2017. Wet weather during the spring and summer of 2017 as measured at Newark Airport and Teterboro Airports was higher than normal resulting in our ability to use a relatively large number of wet weather events for calibration and verification of the wet weather components of the model, but limited the data available for dry weather calibration. Monitoring data for the period of April 13 to April 19, 2017 was used for dry weather calibration of the model. Overall, modeling results for both wet and dry weather model calibration were within acceptable limits. One difficulty encountered during the calibration/verification period was that the interconnections between the Overpeck Creek Trunk and Relief Sewers made it very difficult to model the flow split going into each pipe downstream of the chamber. This was especially true for Meters 1 and 2 since meter placement noted that due to unknown reasons flow in the Trunk Sewer downstream of Junction Chamber (JC) 2, the flow was not flows towards the WCPF as anticipated, but rather towards JC2. Only under certain high flow conditions did positive flow develop in the Trunk Sewer towards to WPCF. Nevertheless the model was able to accurately predict the total flow being carried by both the Trunk and Relief Sewers in all cases.

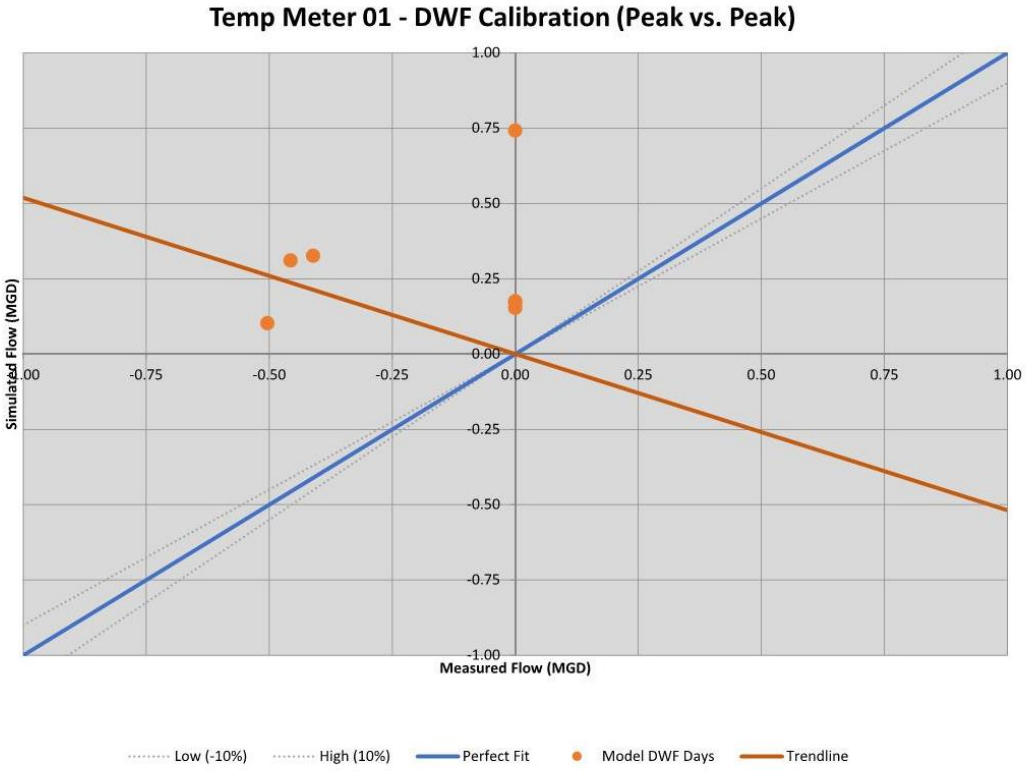
Dry weather calibration statistics and graphics are provided for each individual or grouped temporary flow metering location(s) used during calibration. Each meter starts with information on simulated and measured peak flow and volume followed by a graphical representation of simulated vs measured flow and how well the measured vs predicted flows fell with WaPUG guidelines. The same format is used for the wet weather calibrations as noted in Section 8.3. Overall most data fell within acceptable guidelines.

Table 8-1 - DWF Calibration Temp Meter 01

DWF Calibration Statistics - Temp Meter 01			
Category	**Simulated**	**Measured**	**Error**
Peak Flow (Avg) - MGD	0.28	-0.20	**-244.4%**
Volume - MG	-1.10	-6.23	**-82.4%**
Depth (Avg) - in	7.00	10.53	**-3.5**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	0.74	0.00	-0.02	-0.92
4/14/17	0.18	0.00	-0.18	-0.95
4/15/17	0.15	0.00	-0.21	-0.79
4/16/17	0.17	0.00	-0.22	-0.70
4/17/17	0.10	-0.50	-0.22	-0.97
4/18/17	0.33	-0.41	-0.12	-0.95
4/19/17	0.31	-0.46	-0.12	-0.94




Temp Meter 01 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

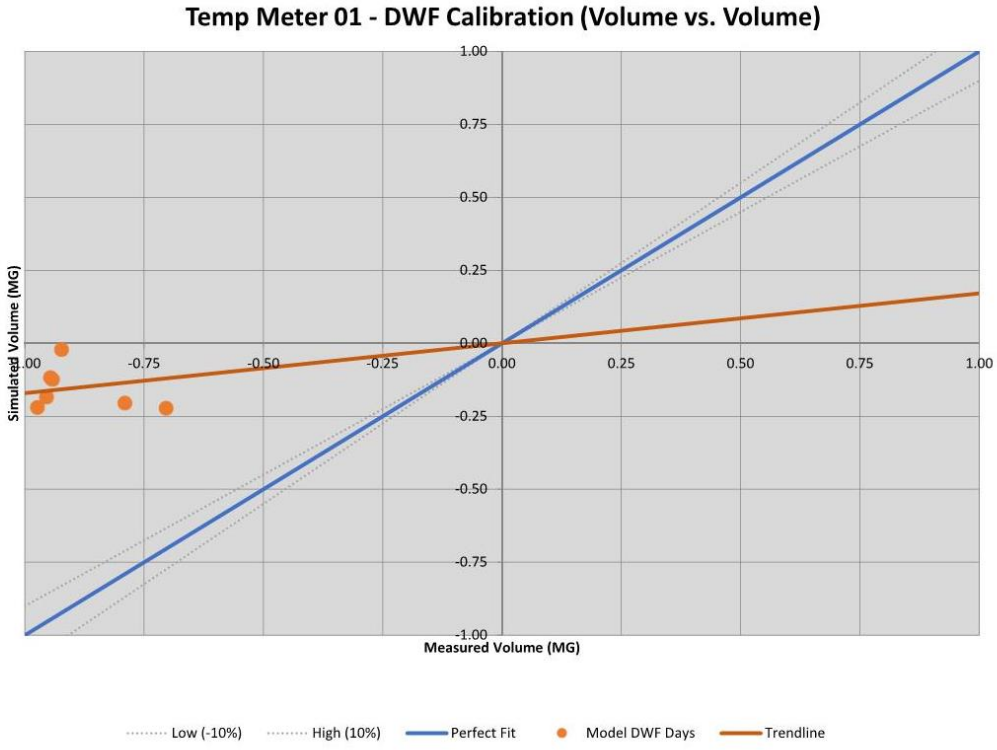
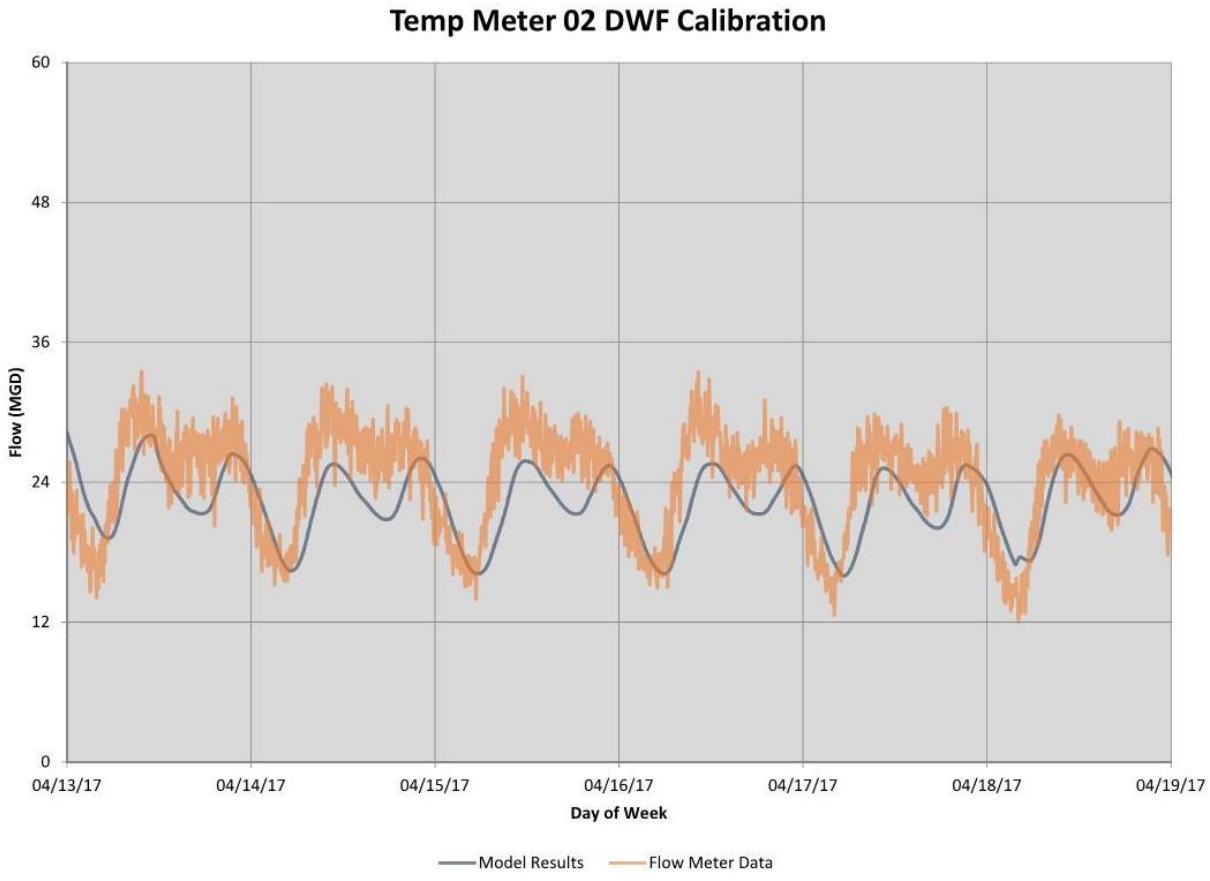
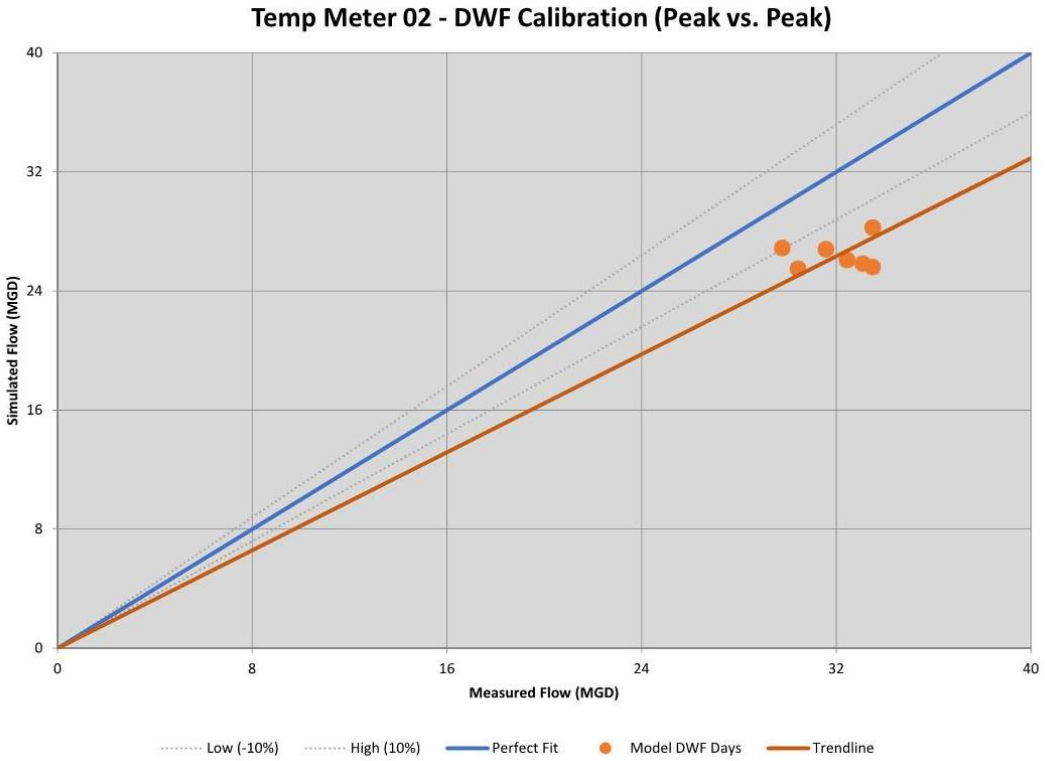

Temp Meter 01 - DWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
1.00
0.75
0.50
0.25
0.00
-0.25
-0.50
-0.75
-1.00
-0.75
-0.50
-0.25
0.00
0.25
0.50
0.75
1.00
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-2 DWF Calibration Temp Meter 2

DWF Calibration Statistics - Temp Meter 02			
Category	**Simulated**	**Measured**	**Error**
Peak Flow (Avg) - MGD	26.42	32.05	**-17.6%**
Volume - MG	156.87	167.54	**-6.4%**
Depth (Avg) - in	25.22	30.66	**-5.4**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	28.25	33.50	23.79	25.15
4/14/17	26.08	32.45	22.18	24.71
4/15/17	25.83	33.09	21.96	24.50
4/16/17	25.60	33.49	21.87	24.26
4/17/17	25.50	30.43	21.73	23.51
4/18/17	26.88	29.78	22.67	22.80
4/19/17	26.81	31.58	22.67	22.60




Temp Meter 02 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
8
16
24
32
40
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

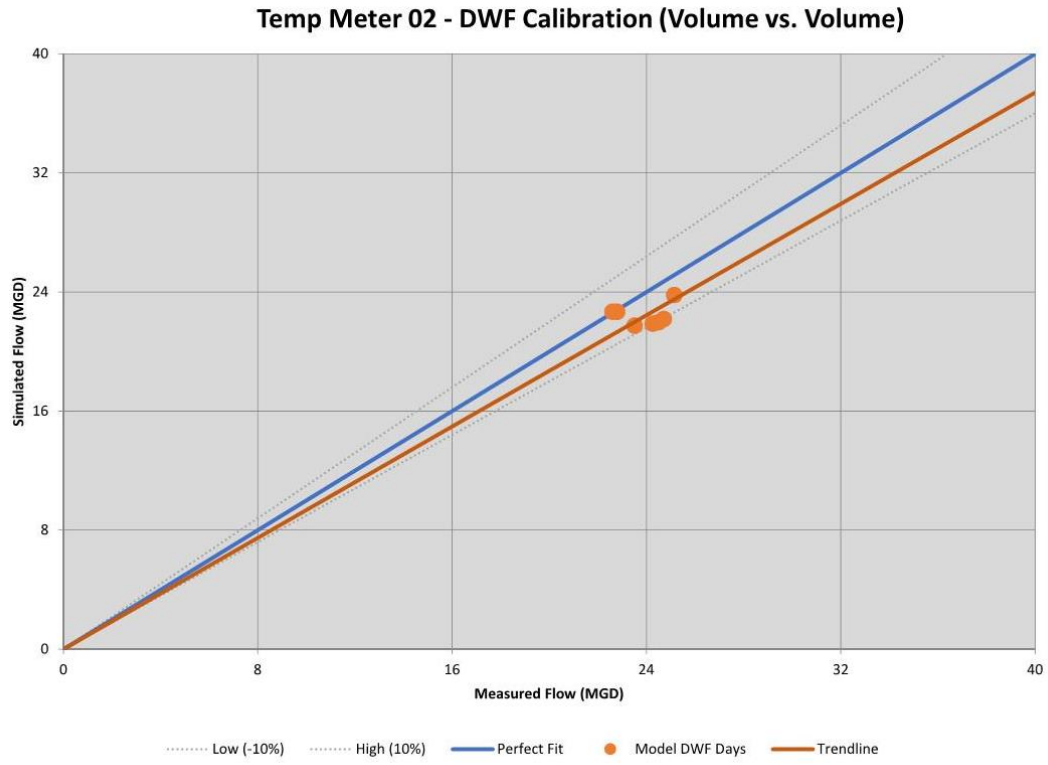
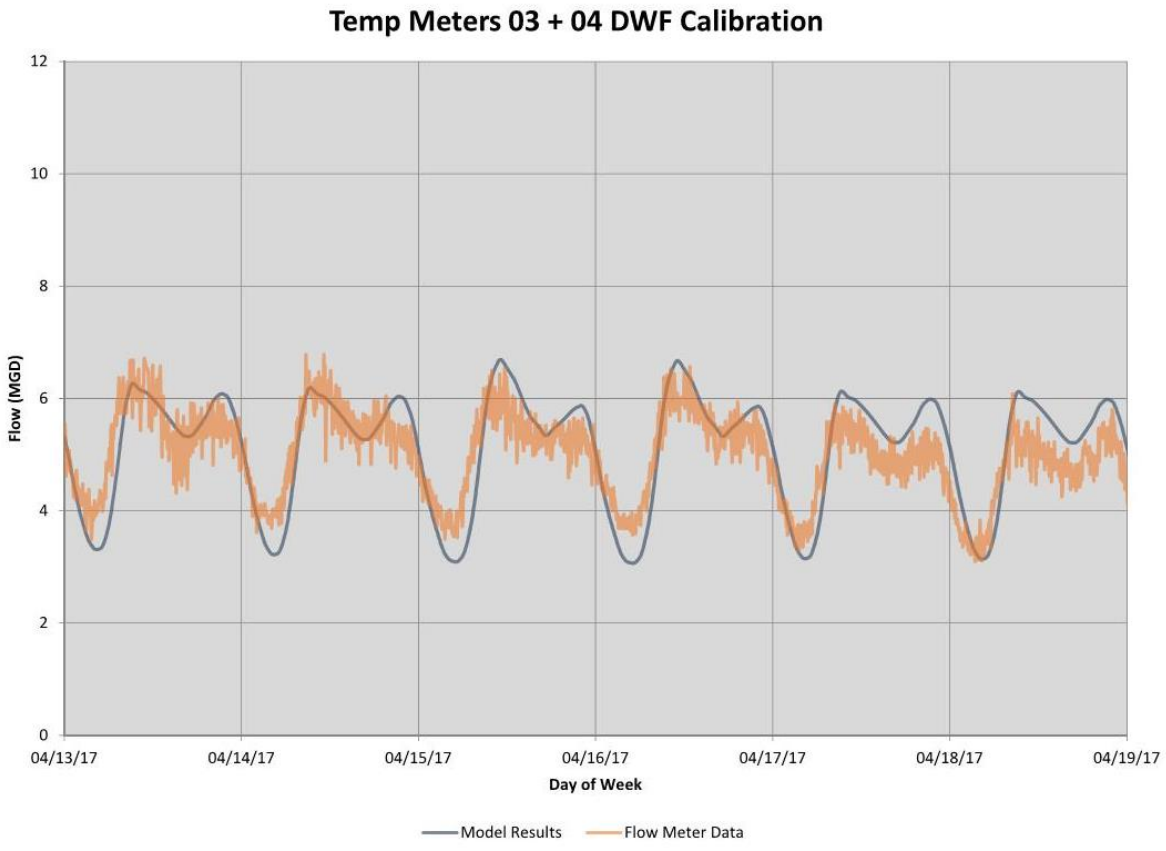
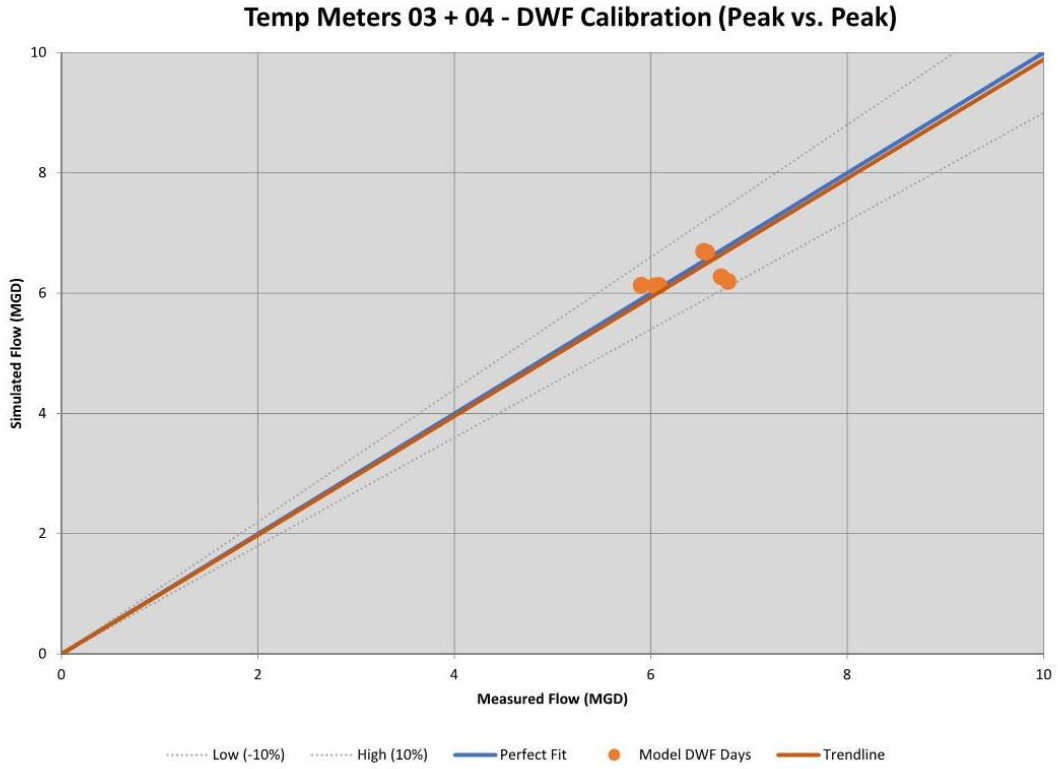

Temp Meter 02 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
8
16
24
32
40
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-3 DWF Calibration Temp Meters 03 & 04

DWF Calibration Statistics - Temp Meters 03 + 04			
Category	**Simulated**	**Measured**	**% Error**
Peak Flow (Avg) - MGD	6.32	6.38	**-1.0%**
Volume - MG	35.82	34.74	**3.1%**
Depth (Avg) - in			

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	6.27	6.72	5.22	5.29
4/14/17	6.19	6.79	5.15	5.22
4/15/17	6.70	6.54	5.11	5.06
4/16/17	6.68	6.57	5.09	5.08
4/17/17	6.13	5.90	5.09	4.77
4/18/17	6.13	6.08	5.08	4.64
4/19/17	6.12	6.04	5.08	4.68




Temp Meters 03 + 04 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
2
4
6
8
10
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

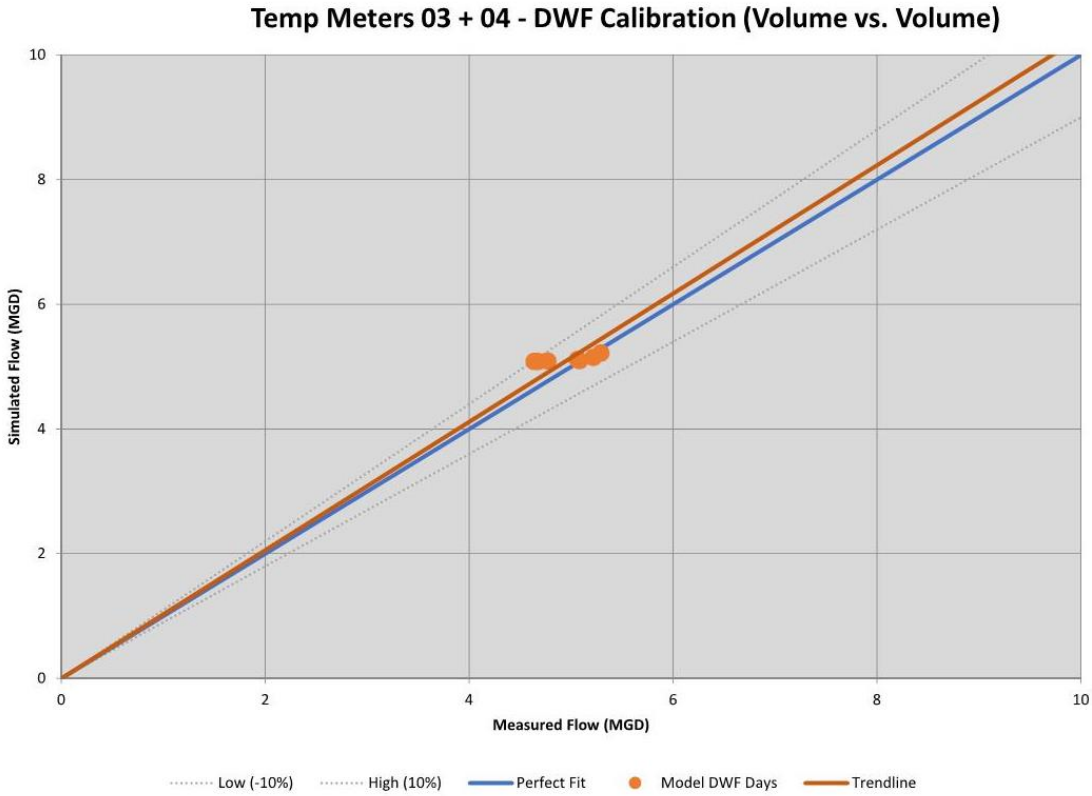
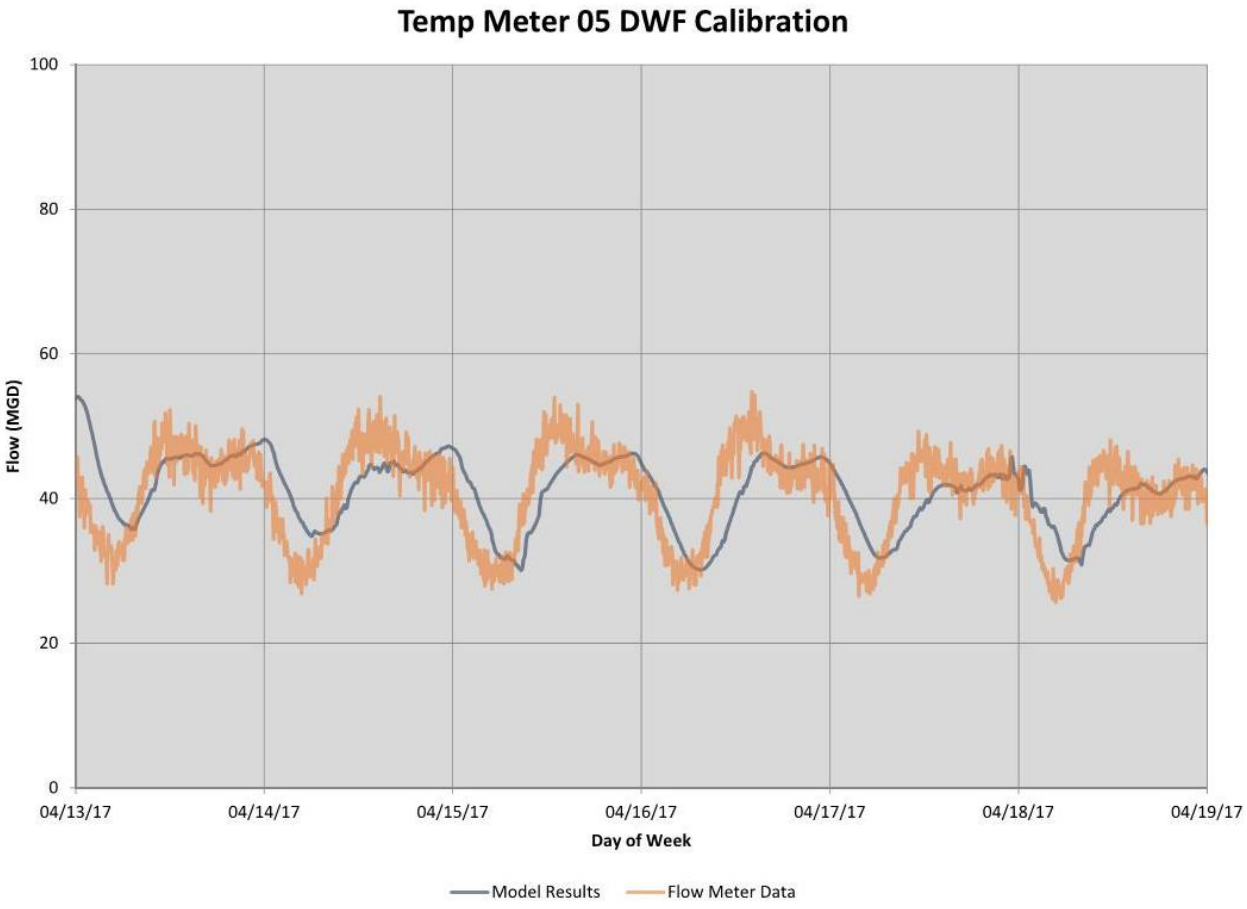
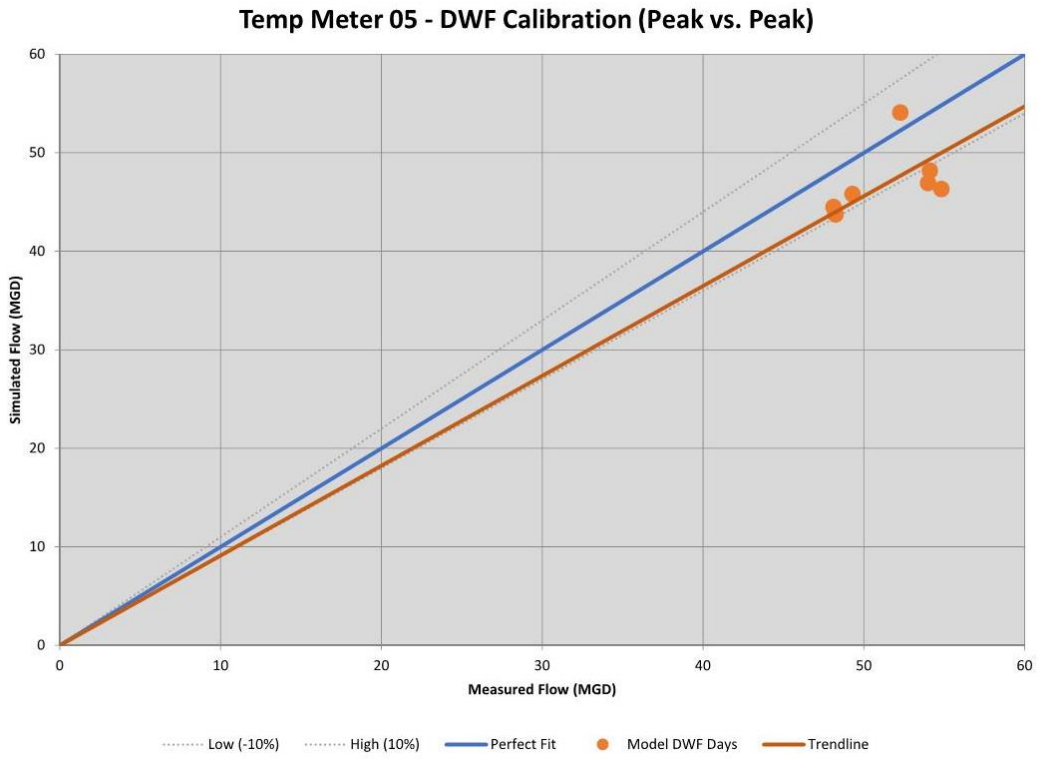

Temp Meters 03 + 04 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
2
4
6
8
10
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-4 DWF Calibration - Temp Meter 5

DWF Calibration Statistics - Temp Meter 05			
Category	**Simulated**	**Measured**	**Error**
Peak Flow (Avg) - MGD	47.07	51.55	**-8.7%**
Volume - MG	284.67	281.67	**1.1%**
Depth (Avg) - in	42.29	43.78	**-1.49**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	54.08	52.28	44.34	42.09
4/14/17	48.17	54.10	42.08	41.31
4/15/17	46.91	53.99	41.07	41.06
4/16/17	46.31	54.83	40.08	40.99
4/17/17	45.80	49.30	39.32	39.82
4/18/17	44.49	48.12	39.06	38.64
4/19/17	43.74	48.24	38.71	37.76




Temp Meter 05 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
10
20
30
40
50
60
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

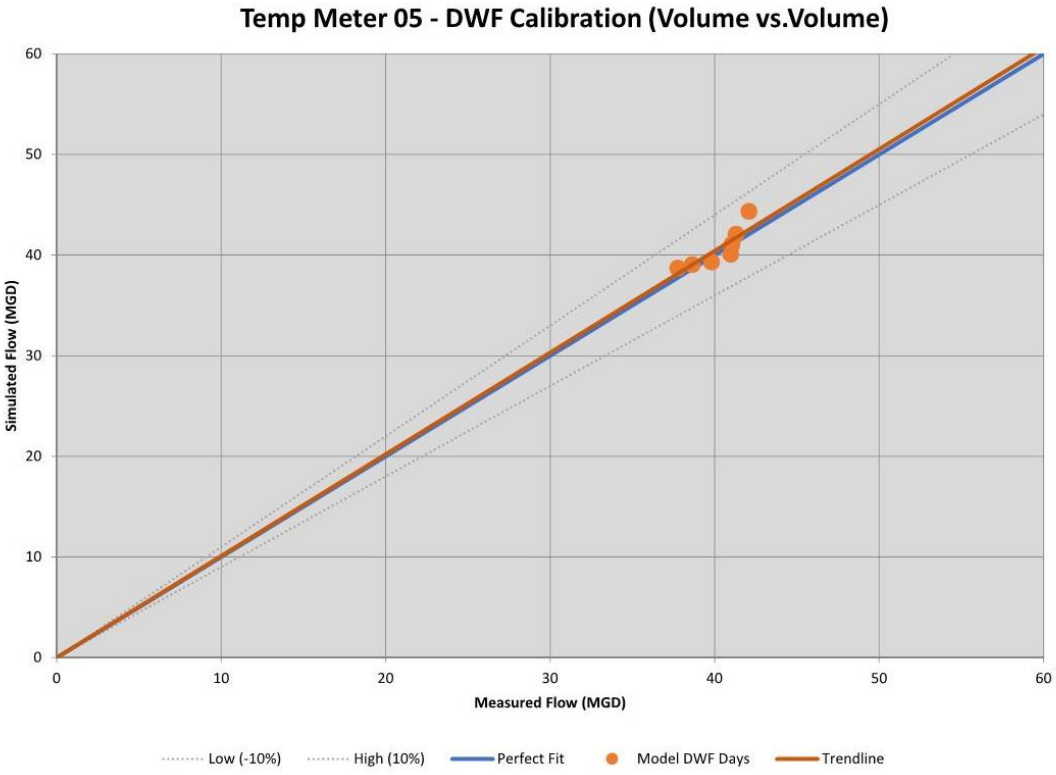
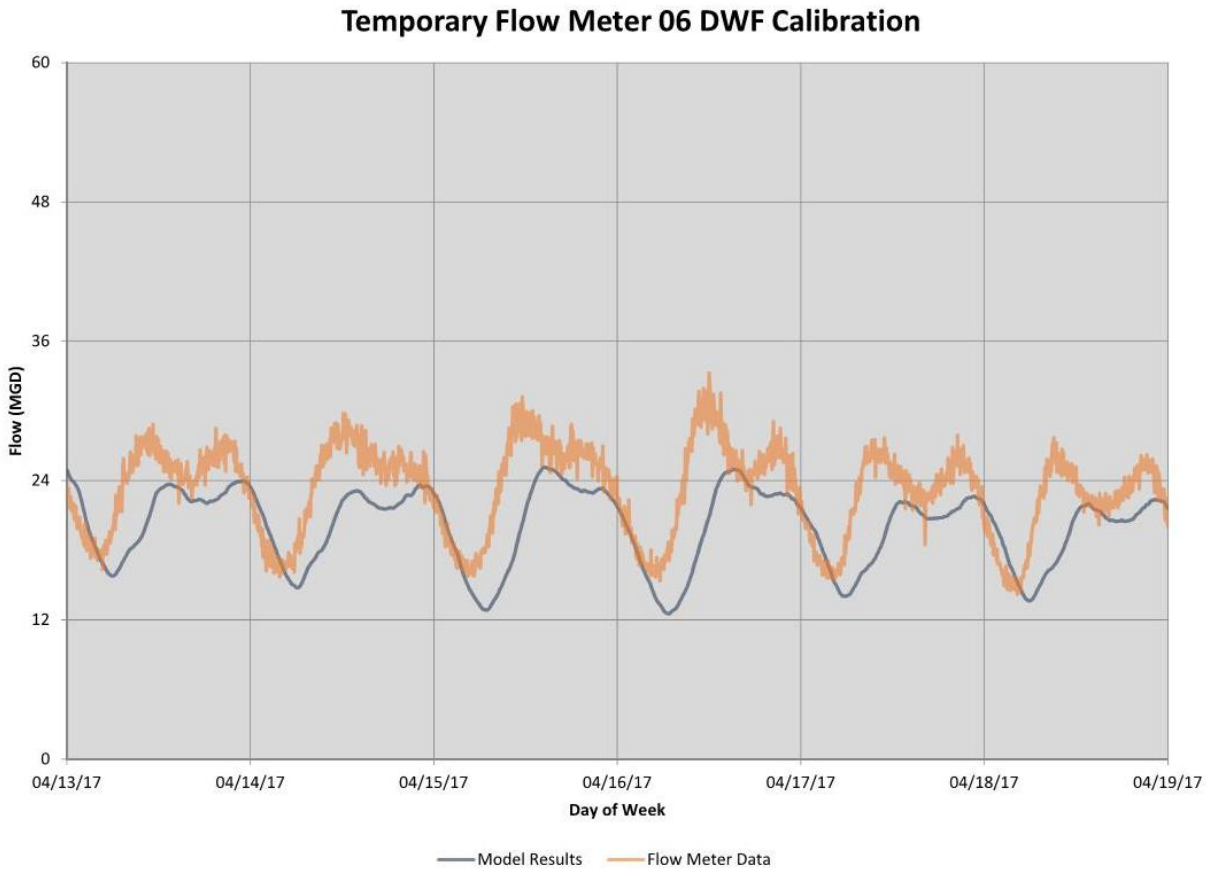
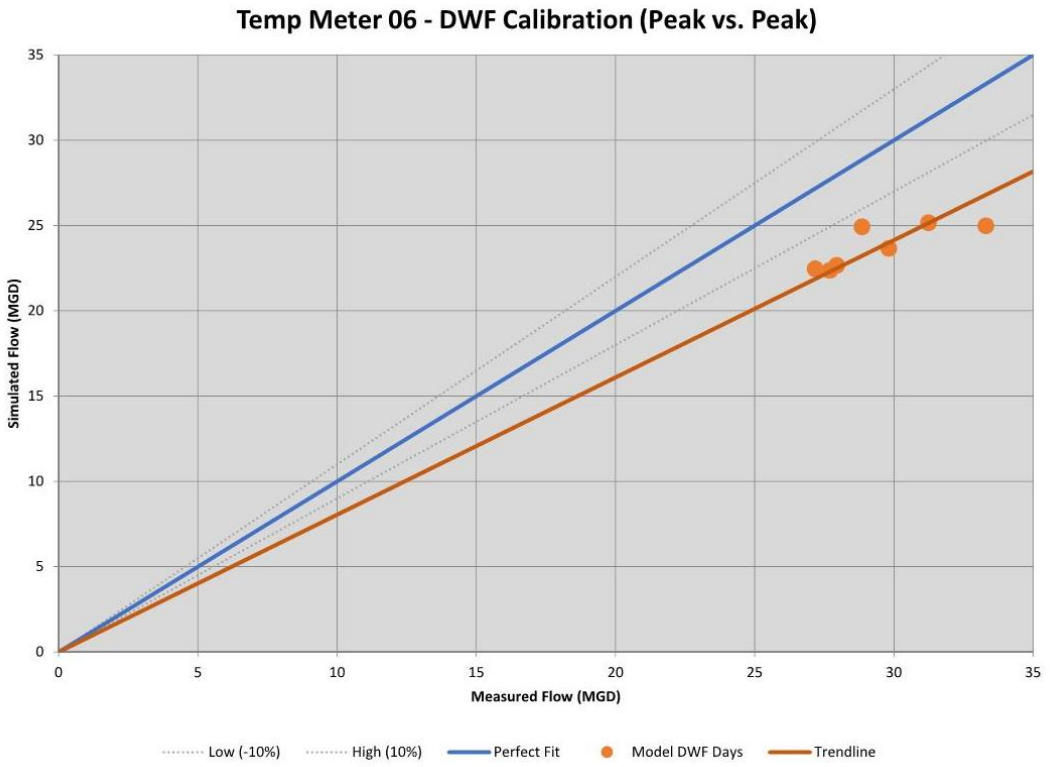

Temp Meter 05 - DWF Calibration (Volume vs.Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
10
20
30
40
50
60
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-5 DWF Calibration - Temp Meter 06

DWF Calibration Statistics - Temp Meter 06			
Category	**Simulated**	**Measured**	**Error**
Peak Flow (Avg) - MGD	23.74	29.44	**-19.3%**
Volume - MG	139.60	160.75	**-13.2%**
Depth (Avg) - in	30.08	33.01	**-2.93**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	24.92	28.86	21.24	23.83
4/14/17	23.65	29.82	20.47	23.45
4/15/17	25.16	31.24	20.18	23.80
4/16/17	24.98	33.31	19.83	23.72
4/17/17	22.66	27.95	19.48	22.55
4/18/17	22.36	27.70	19.30	21.79
4/19/17	22.46	27.17	19.09	21.61




Temp Meter 06 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
5
10
15
20
25
30
35
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

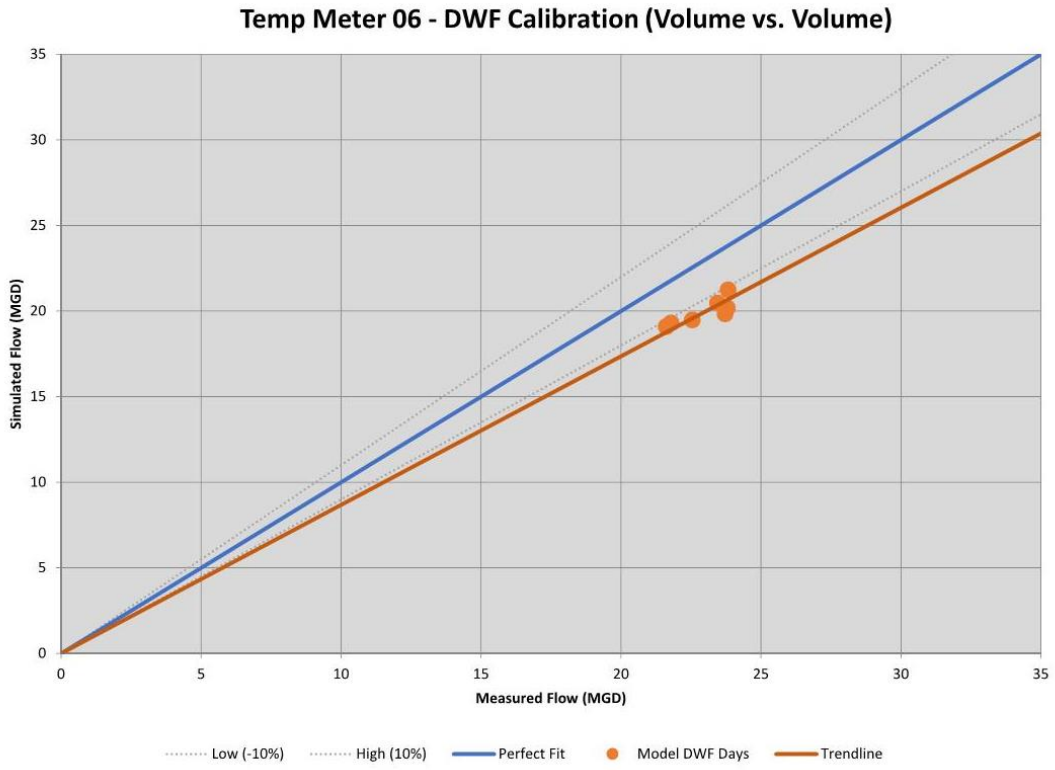
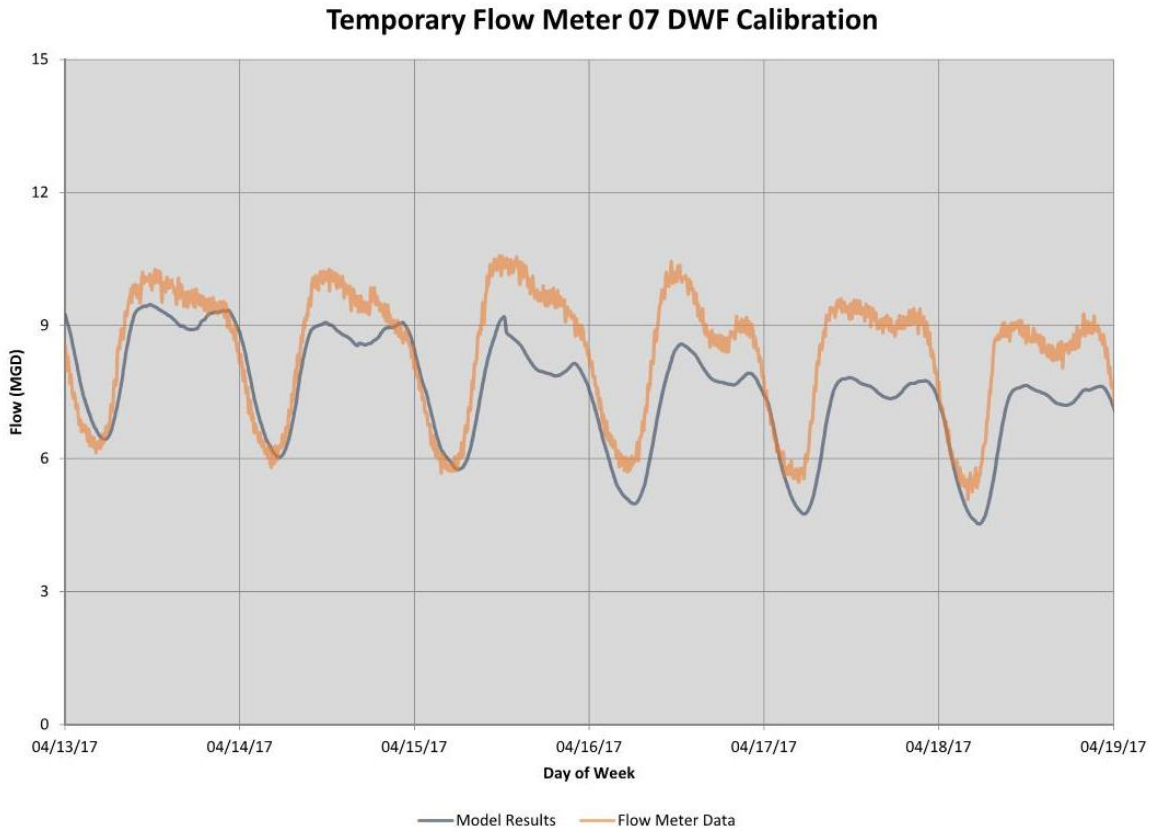
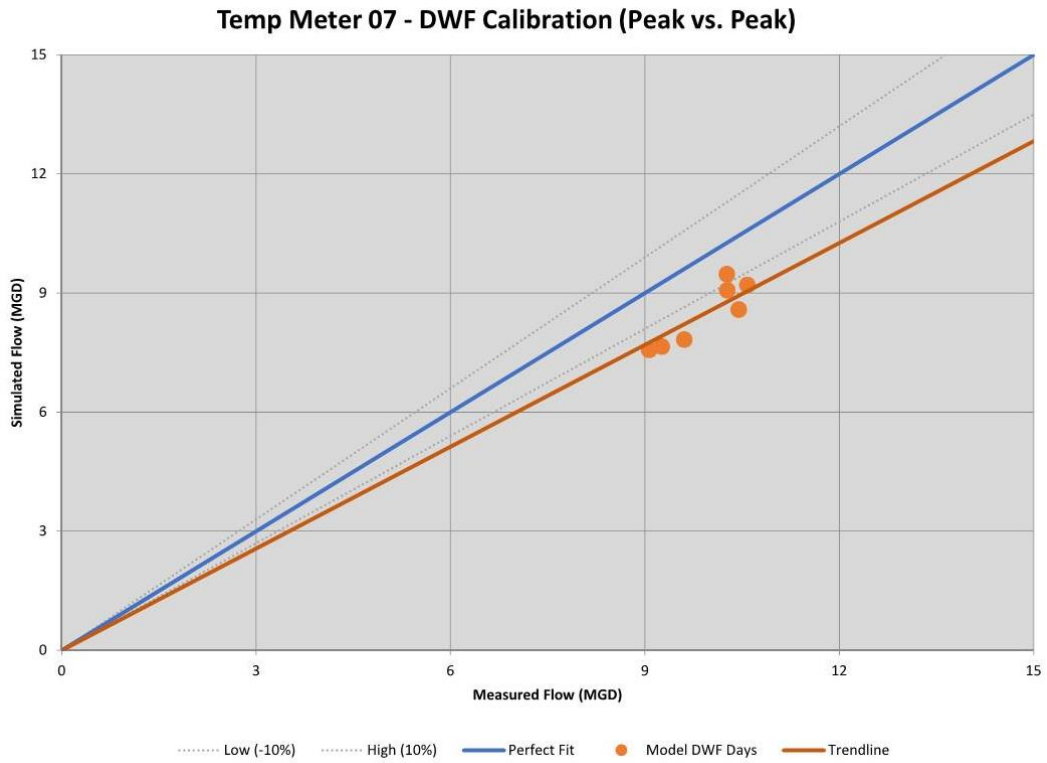

Temp Meter 06 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
5
10
15
20
25
30
35
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-6 DWF Calibration - Temp Meter 07

DWF Calibration Statistics - Temp Meter 07			
Category	**Simulated**	**Measured**	**% Error**
Peak Flow (Avg) - MGD	8.48	9.93	**-14.6%**
Volume - MG	51.80	58.16	**-10.9%**
Depth (Avg) - in	16.08	17.73	**-9.3%**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	9.47	10.27	8.56	8.78
4/14/17	9.07	10.27	8.17	8.57
4/15/17	9.20	10.58	7.63	8.60
4/16/17	8.58	10.45	7.13	8.27
4/17/17	7.83	9.61	6.92	8.23
4/18/17	7.65	9.26	6.74	7.90
4/19/17	7.57	9.07	6.65	7.81




Temp Meter 07 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
3
6
9
12
15
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

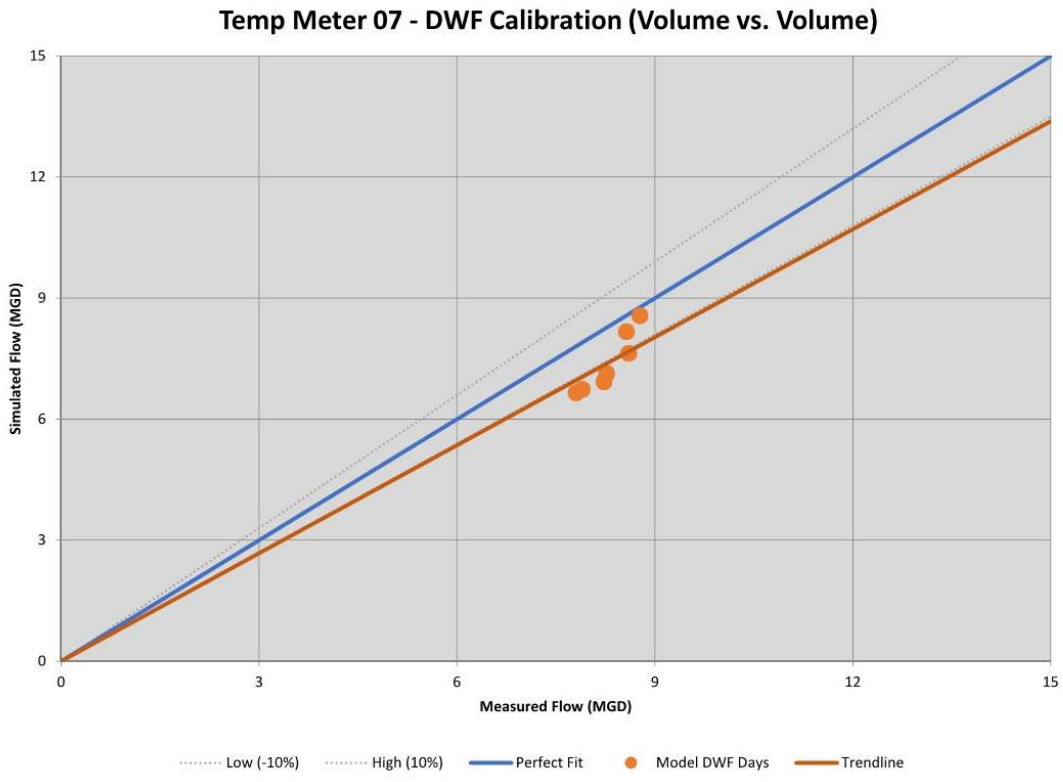
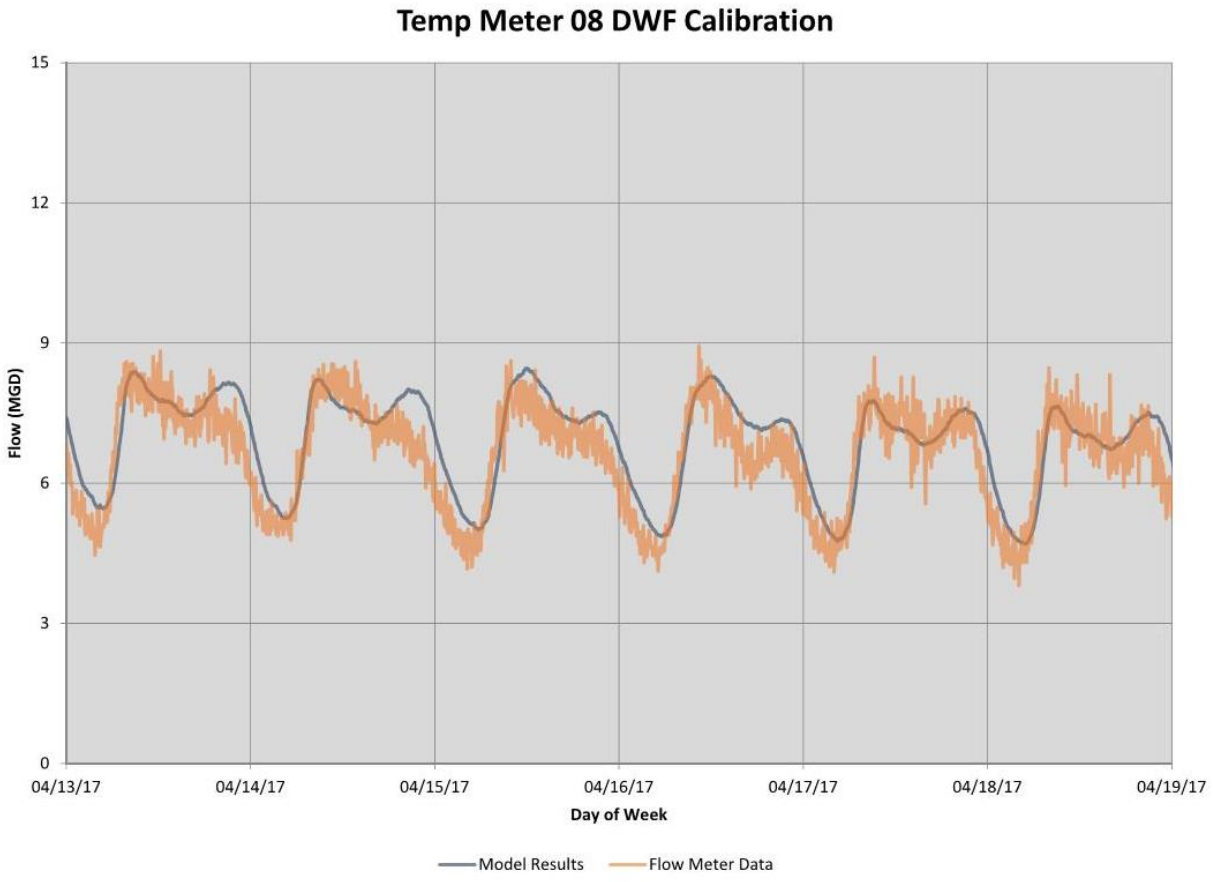
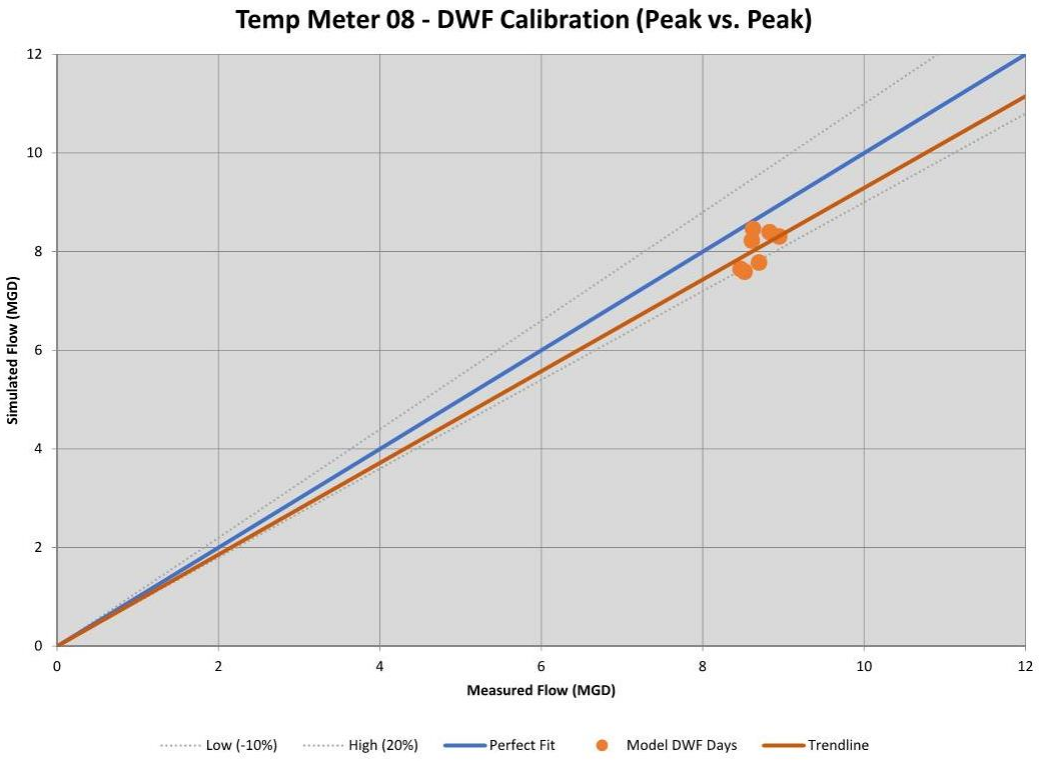

Temp Meter 07 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
3
6
9
12
15
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

Table 8-7 DWF Calibration - Temp Meter 08

DWF Calibration Statistics - Temp Meter 08			
Category	**Simulated**	**Measured**	**Error**
Peak Flow (Avg) - MGD	8.06	8.67	**-7.1%**
Volume - MG	48.02	46.01	**4.4%**
Depth (Avg) - in	15.67	25.04	**-9.4**

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	8.39	8.83	7.32	6.98
4/14/17	8.22	8.61	7.14	6.81
4/15/17	8.46	8.62	6.98	6.55
4/16/17	8.31	8.95	6.82	6.38
4/17/17	7.78	8.70	6.69	6.58
4/18/17	7.65	8.47	6.59	6.38
4/19/17	7.59	8.52	6.50	6.32




Temp Meter 08 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
2
4
6
8
10
12
Low (-10%)
High (20%)
Perfect Fit
Model DWF Days
Trendline

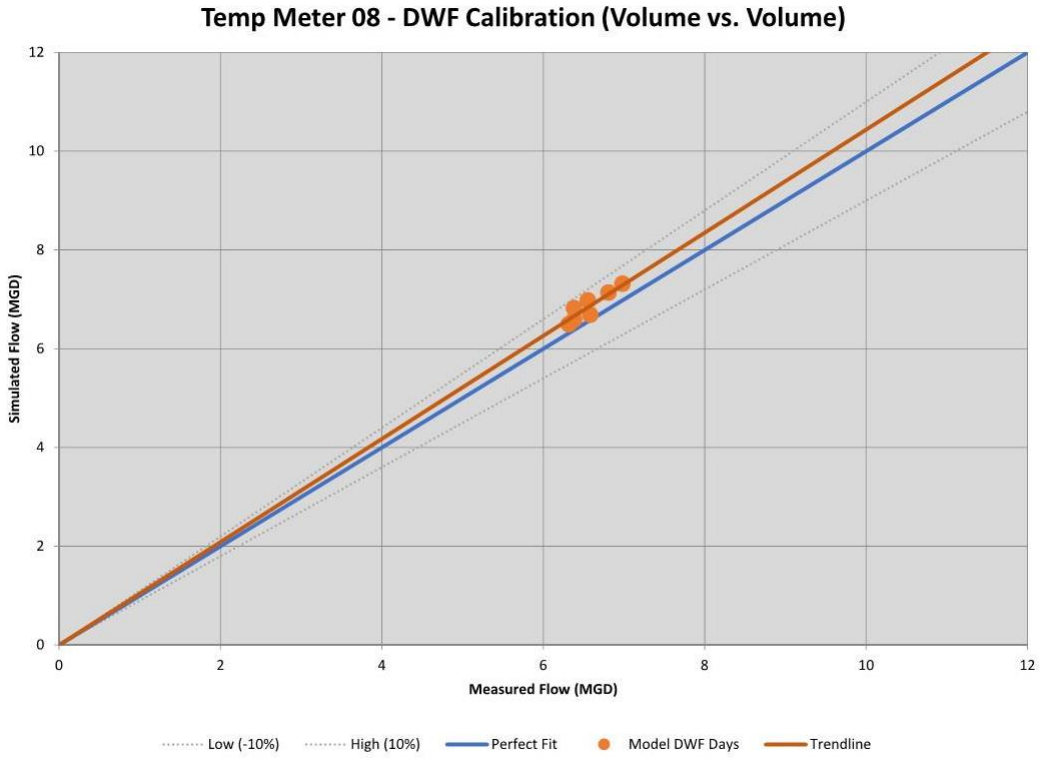
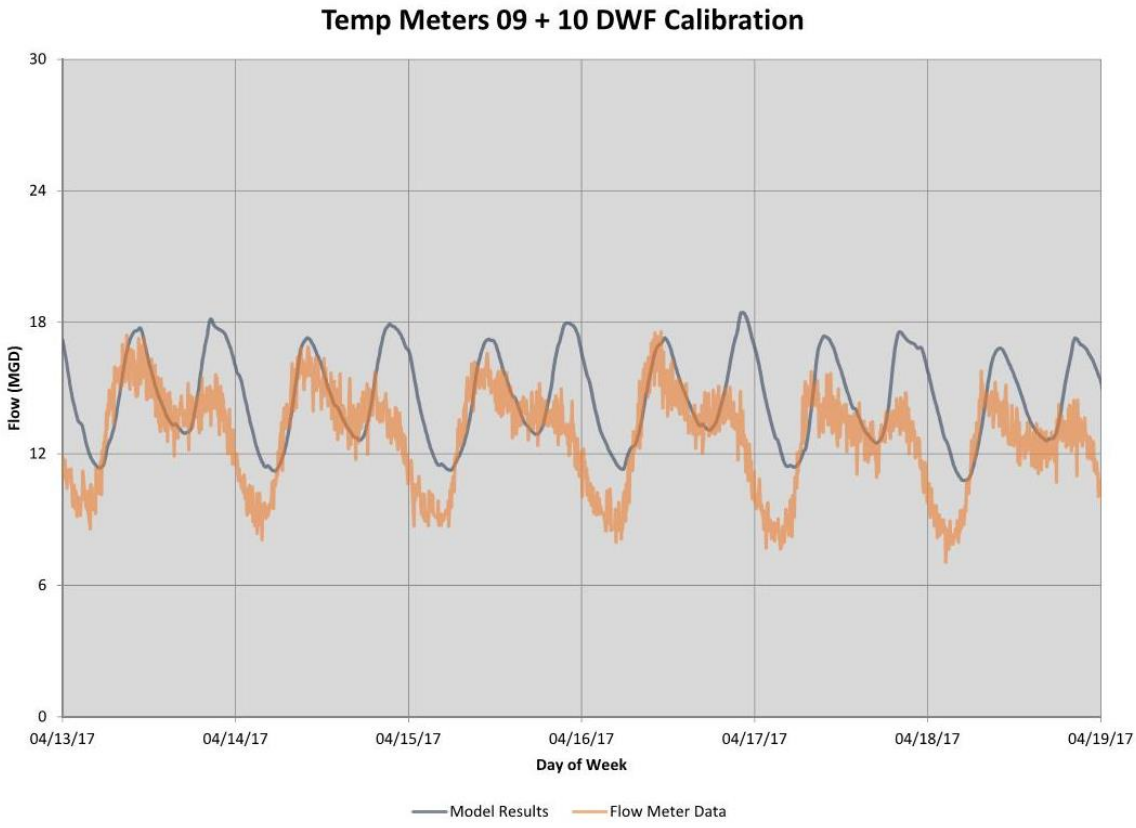
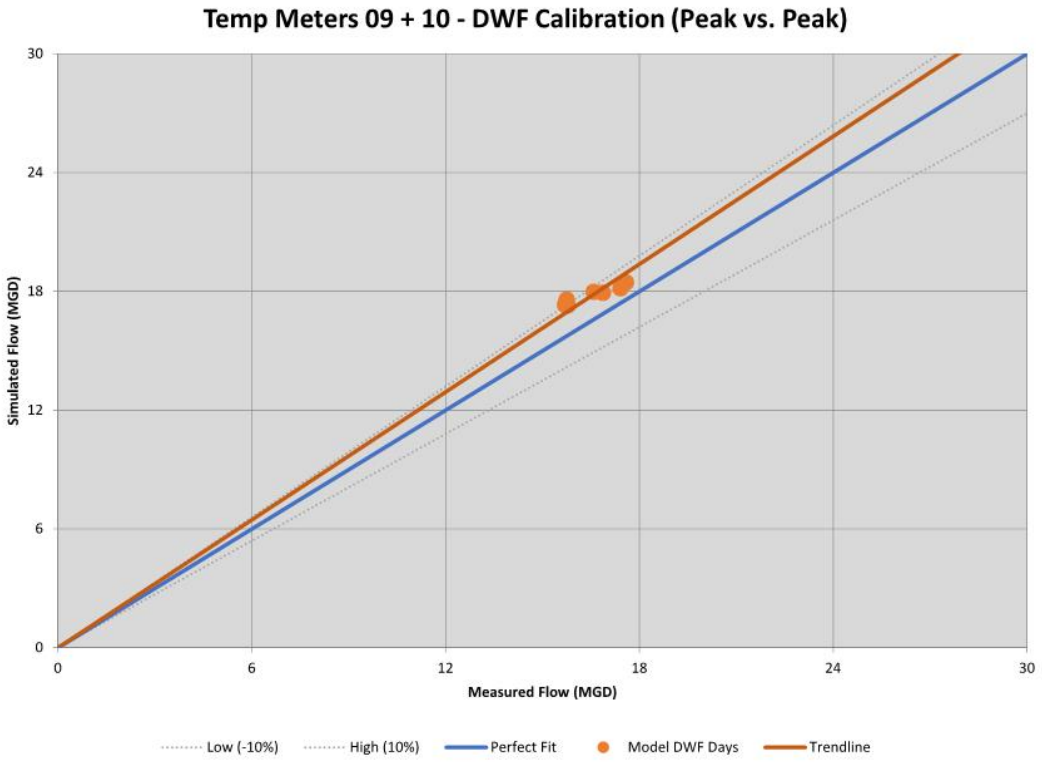

Temp Meter 08 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
2
4
6
8
10
12
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

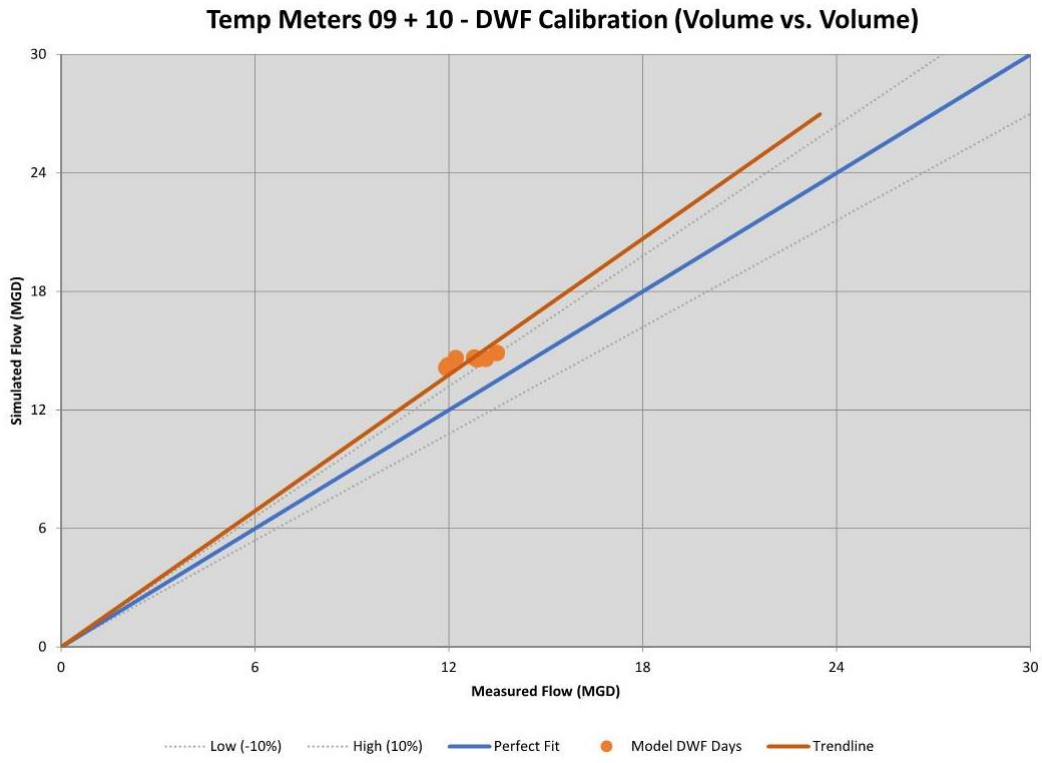
Table 8-8 DWF Calibration - Temp Meter 09 & 10

DWF Calibration Statistics - Temp Meters 09 + 10			
Category	**Simulated**	**Measured**	**% Error**
Peak Flow (Avg) - MGD	17.81	16.53	**7.8%**
Volume - MG	101.69	88.41	**15.0%**
Depth (Avg) - in			

	DWF Peak Flows (MGD)		DWF Volumes (MG)	
DWF Day	**Simulated**	**Measured**	**Simulated**	**Measured**
4/13/17	18.16	17.41	14.88	13.48
4/14/17	17.92	16.87	14.59	13.14
4/15/17	17.97	16.59	14.56	12.88
4/16/17	18.46	17.58	14.65	12.79
4/17/17	17.57	15.75	14.62	12.22
4/18/17	17.29	15.78	14.25	11.97
4/19/17	17.31	15.70	14.13	11.92



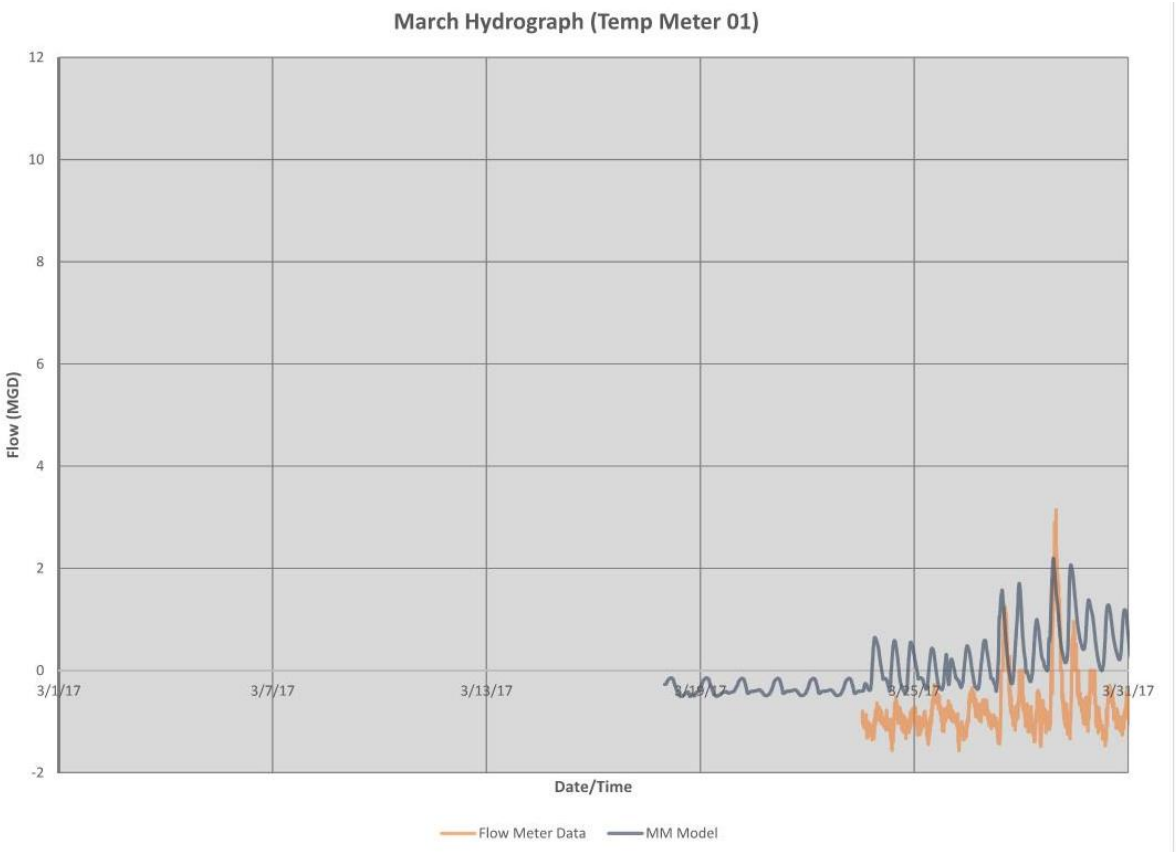

Temp Meters 09 + 10 - DWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
0
6
12
18
24
30
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

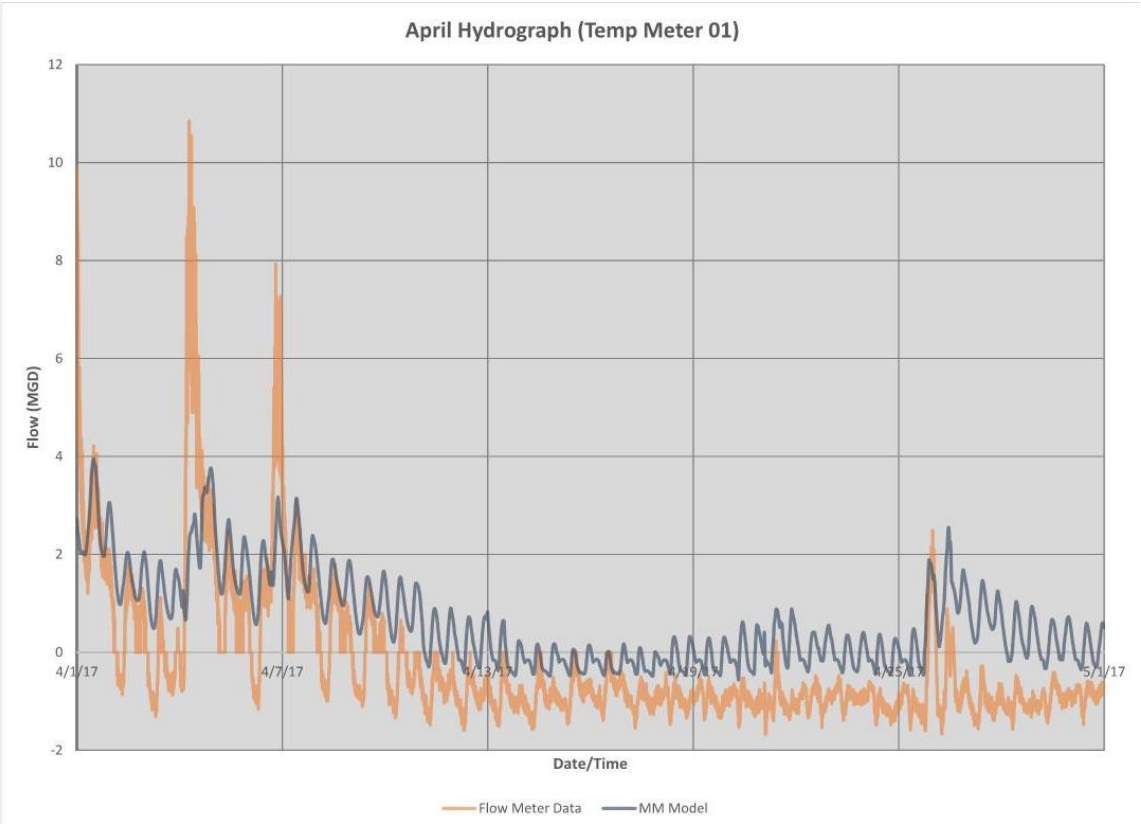

Temp Meters 09 + 10 - DWF Calibration (Volume vs. Volume)
Simulated Flow (MGD)
Measured Flow (MGD)
0
6
12
18
24
30
Low (-10%)
High (10%)
Perfect Fit
Model DWF Days
Trendline

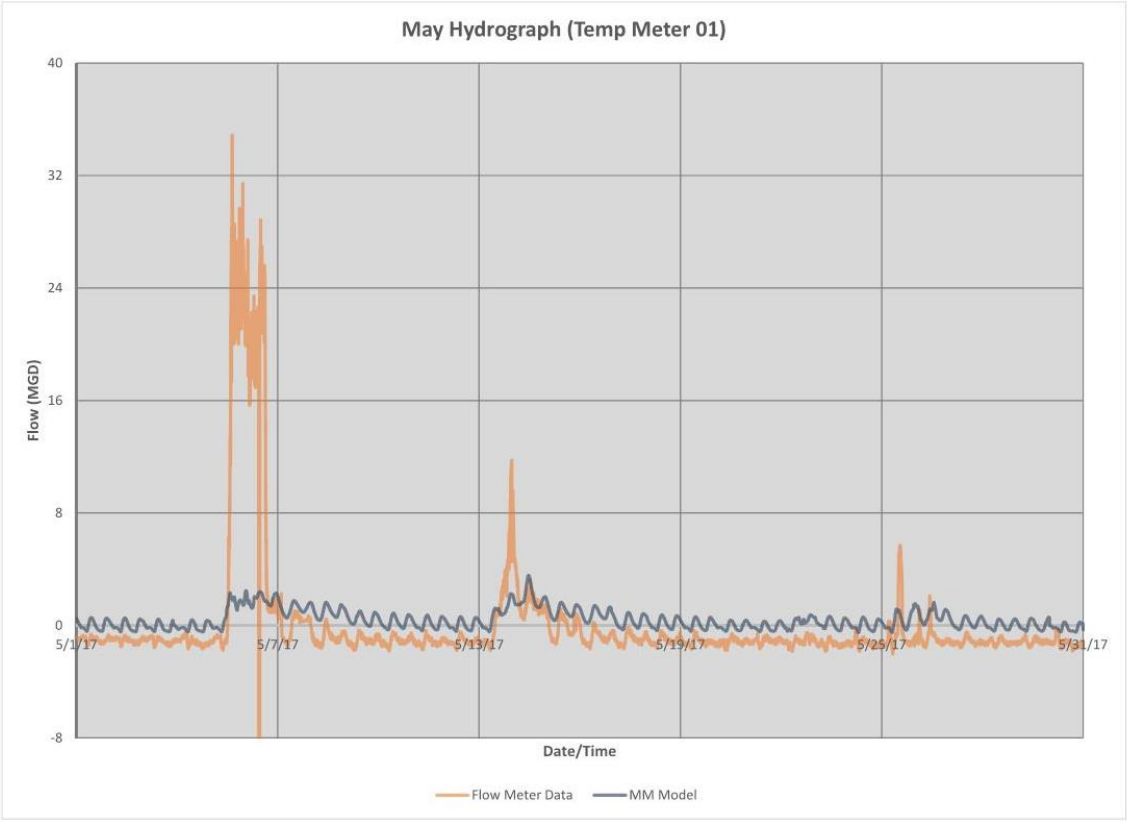
8.3 Wet Weather Calibration Results

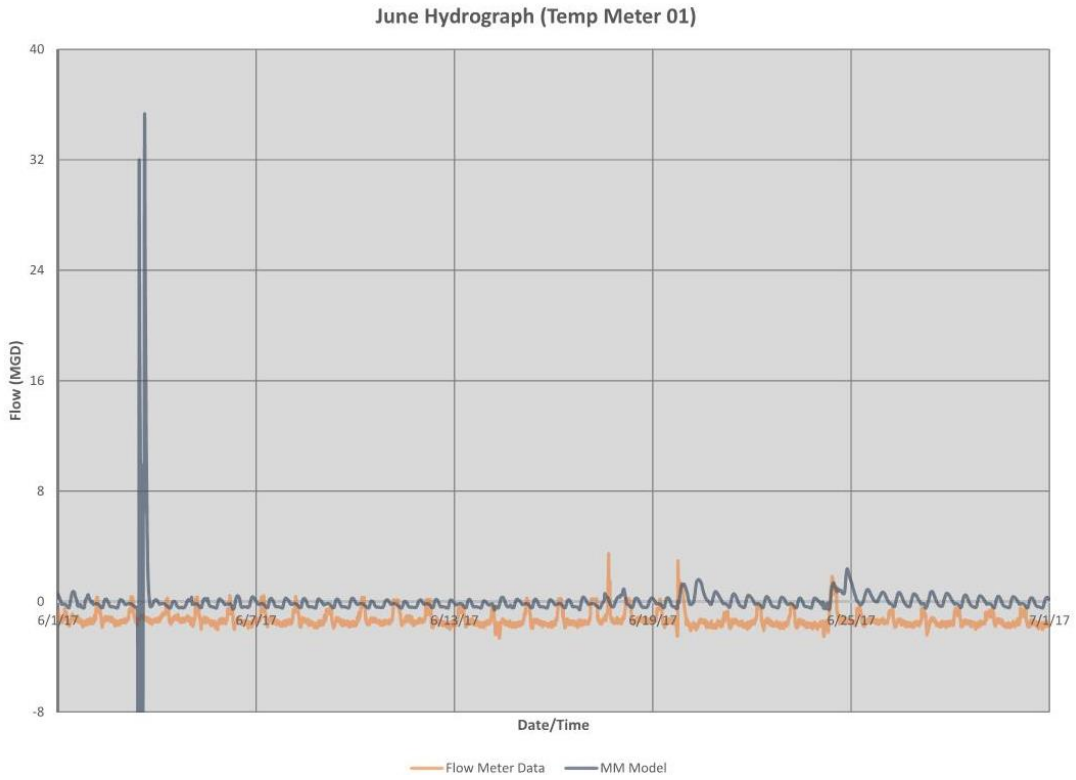
Table 8-9 Temp Meter 01 WW Flow Statistics

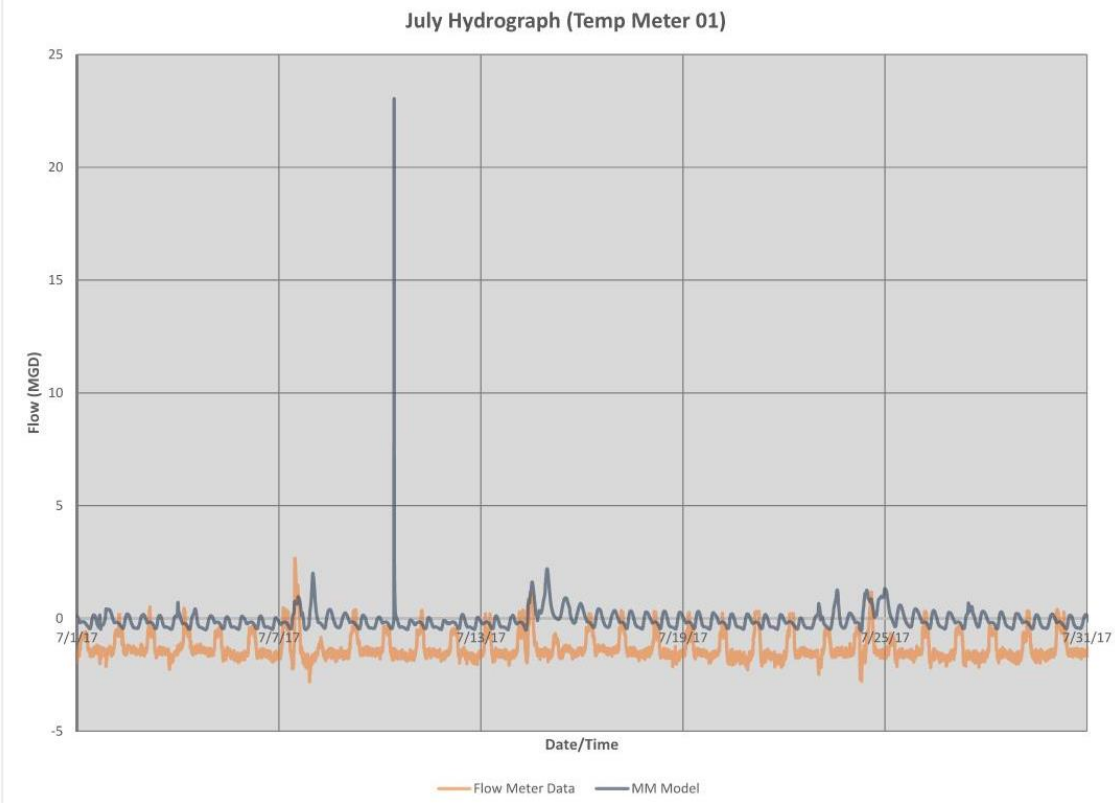
Storm Date	Type	Temp Meter 01 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	10.07	3.95	-155.2%	4.59	6.62	30.7%	28.1	14.5	-13.6
04/20/17	Calibration	-0.52	0.62	183.6%	-0.71	0.02	3272.7%	13.9	8.9	-5.0
04/21/17	Validation	0.23	0.89	73.9%	-1.18	0.25	575.2%	14.9	9.9	-4.9
05/13/17	Validation	11.77	3.56	-230.5%	1.09	4.78	77.2%	25.7	13.5	-12.2
05/25/17	Calibration	5.70	1.63	-249.1%	-2.38	1.34	278.3%	18.0	11.0	-7.0
05/31/17	Calibration	-0.53	0.85	161.8%	-0.34	0.07	578.1%	14.4	11.7	-2.8
06/16/17	Calibration	0.21	0.34	36.4%	-0.60	-0.05	-1167.8%	9.6	8.5	-1.1
06/17/17	Validation	-1.49	-0.13	-1020.2%	-1.39	-0.33	-321.0%	9.9	6.0	-3.9
06/23/17	Calibration	1.83	2.38	23.1%	-2.74	1.05	360.2%	20.3	12.4	-7.8
07/07/17	Calibration	2.68	2.01	-33.1%	-2.46	0.20	1309.1%	20.3	13.4	-6.9
07/22/17	Validation	-0.45	1.26	135.6%	-1.12	0.06	2095.1%	14.0	10.9	-3.0
07/24/17	Calibration	1.17	1.33	12.2%	-2.77	0.61	557.6%	18.3	12.4	-5.9
08/07/17	Calibration	2.48	1.28	-93.9%	-2.34	0.71	426.9%	17.3	11.5	-5.8
08/15/17	Calibration	0.50	0.17	-201.0%	-1.43	-0.23	-519.7%	8.9	8.2	-0.7
08/18/17	Validation	5.94	2.14	-177.1%	-1.71	0.78	319.8%	22.6	14.7	-7.9
Averages		2.64	1.49	-77.7%	-0.66	1.27	151.7%	17.2	11.0	-6.2

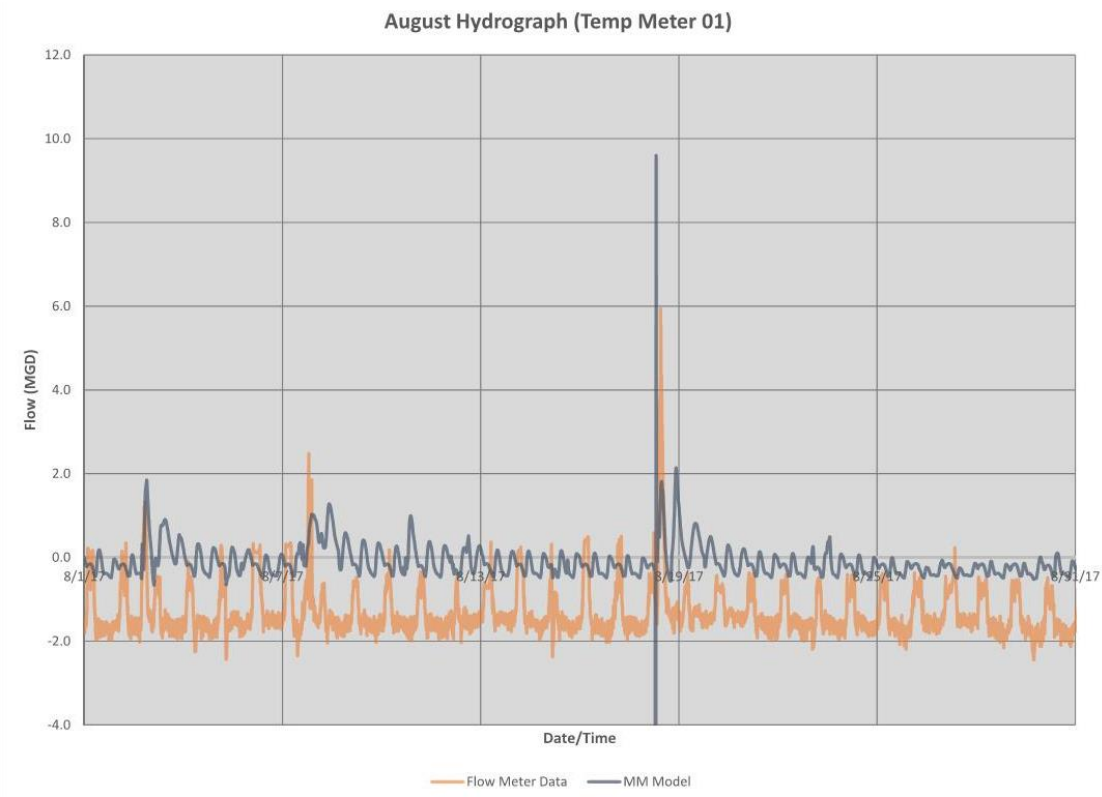


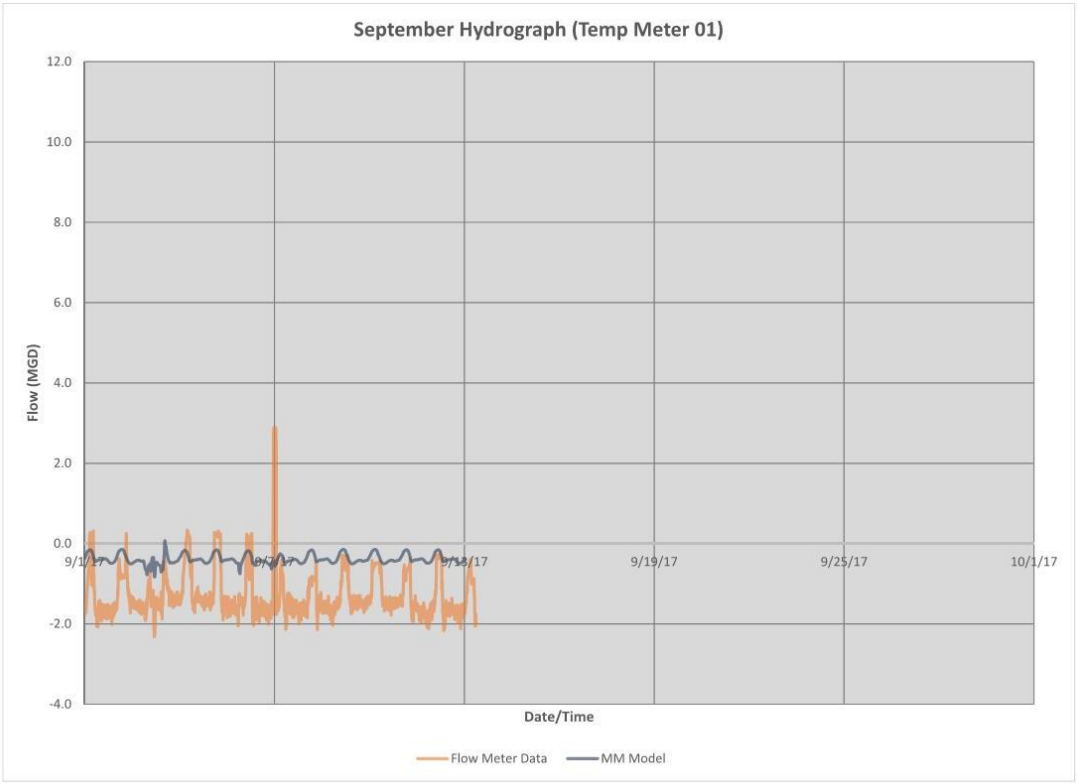

April Hydrograph (Temp Meter 01)
Flow (MGD)
12
10
8
6
4
2
0
-2
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

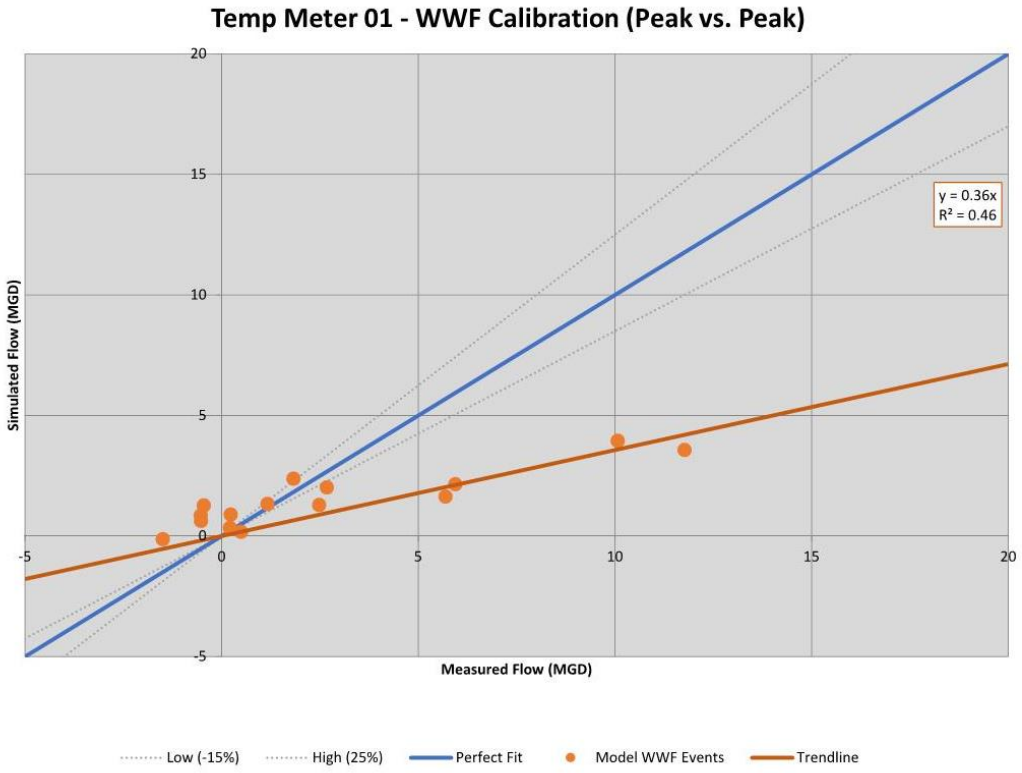

May Hydrograph (Temp Meter 01)
Flow (MGD)
40
32
24
16
8
0
-8
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 01)
40
32
24
16
8
0
-8
Flow (MGD)
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 01)
25
20
15
10
5
0
-5
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meter 01)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
Flow (MGD)
8/1/17
8/7/17
8/13/17
8/19/17
8/25/17
8/31/17
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meter 01)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
Flow (MGD)
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meter 01 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.36x
R² = 0.46
20
15
10
5
0
-5
-5
0
5
10
15
20
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

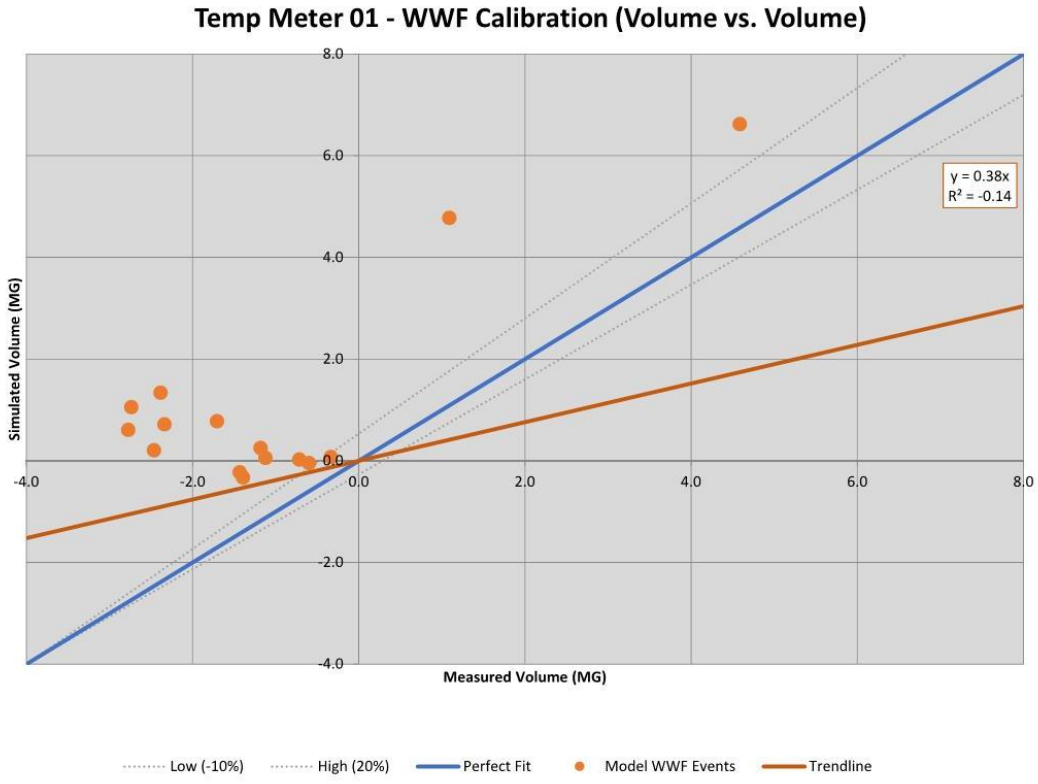
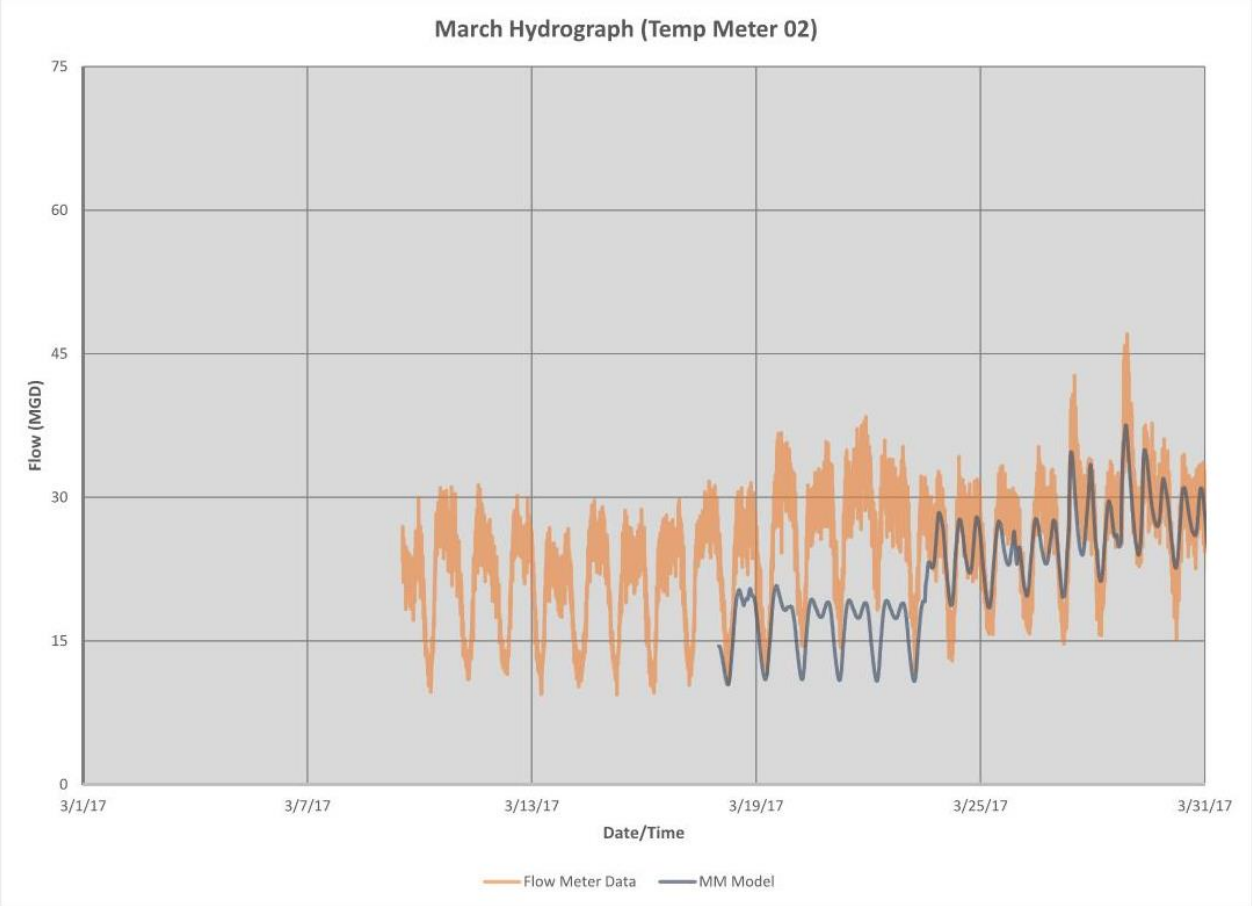
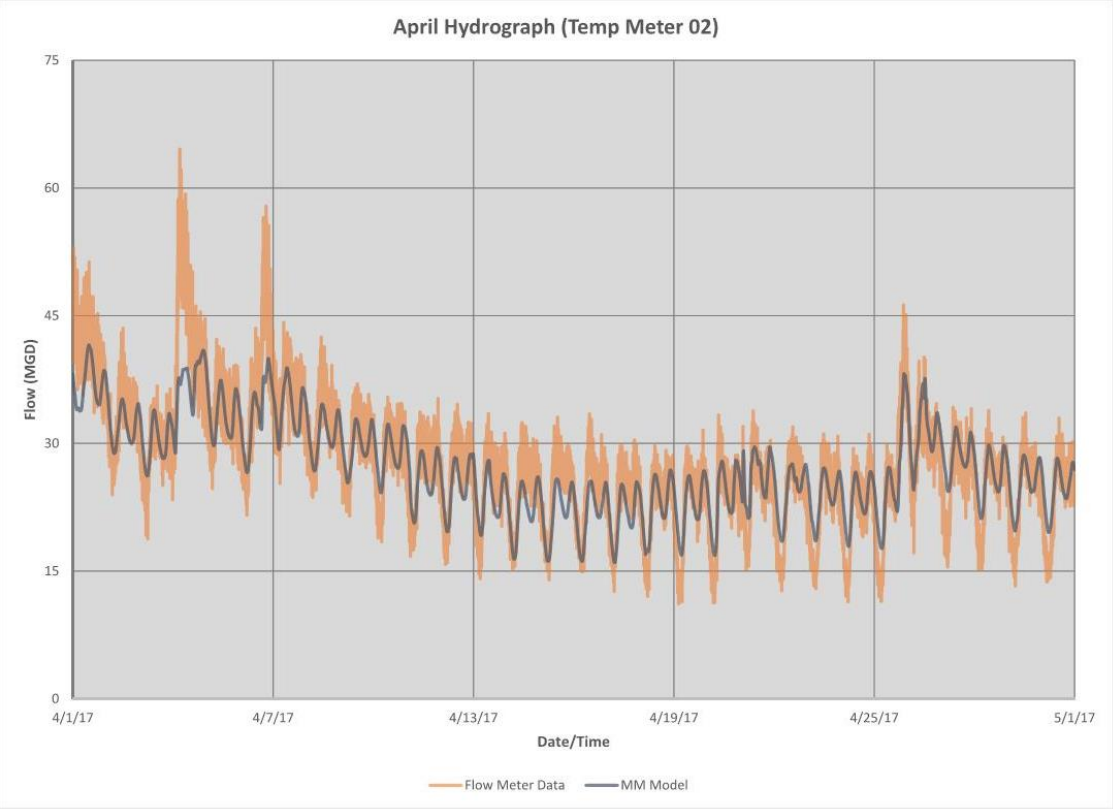
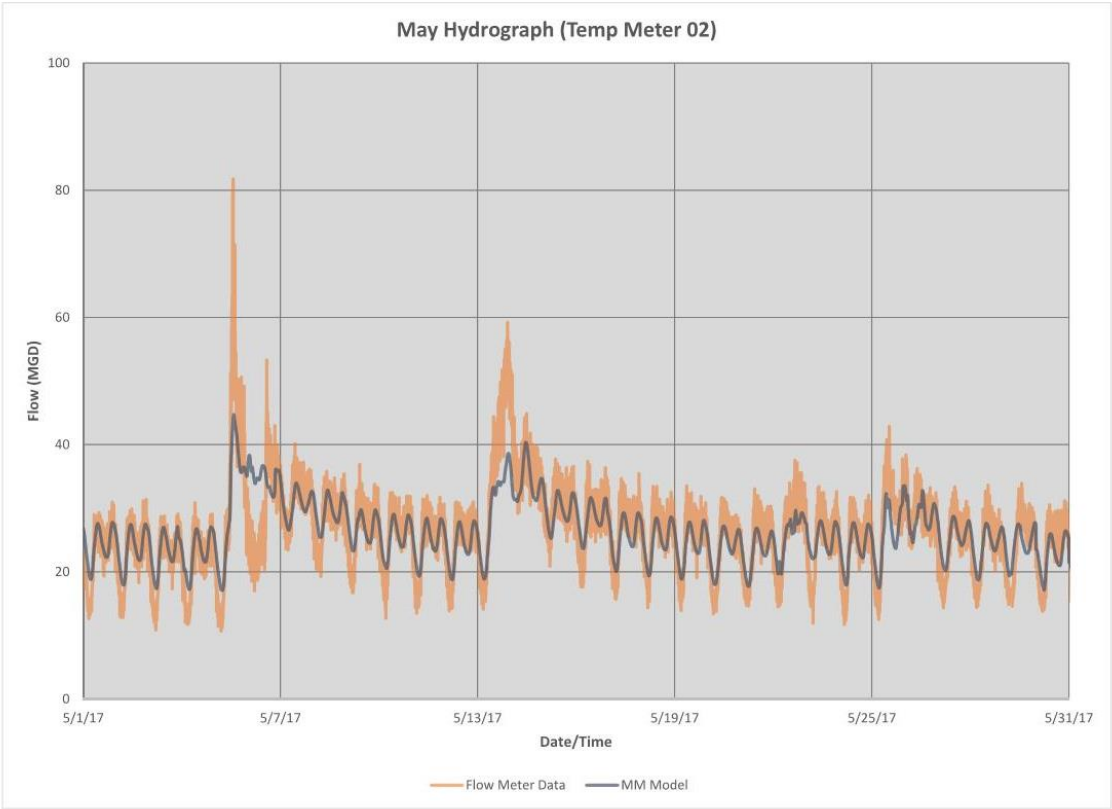

Temp Meter 01 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 0.38x
R² = -0.14
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-4.0
-2.0
0.0
2.0
4.0
6.0
8.0
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

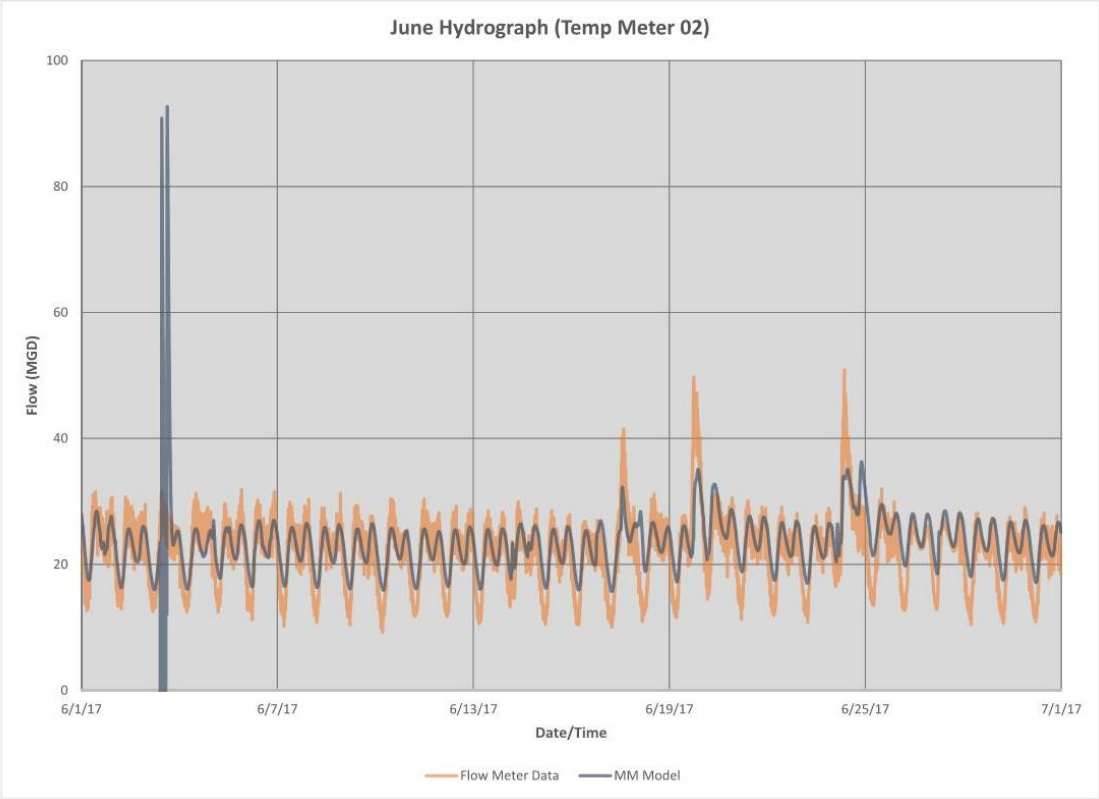
Table 8-10 Temp Meter 02 WW Flow Statistics

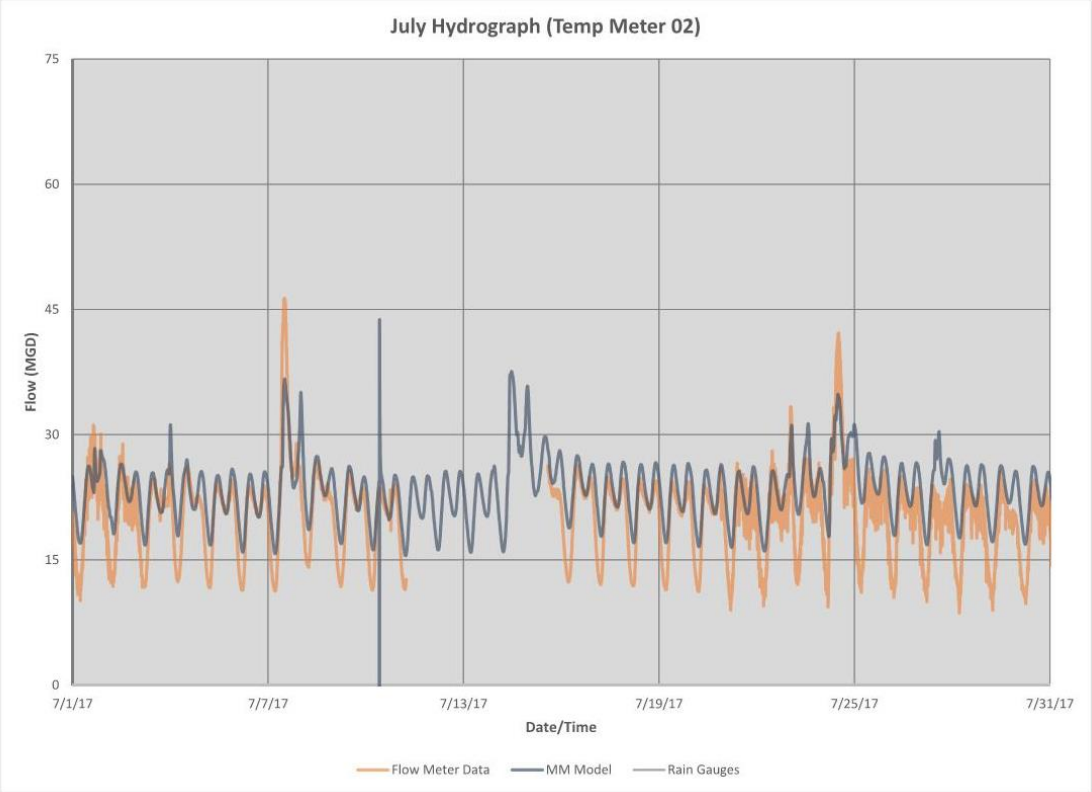
Storm Date	Type	Temp Meter 02 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	65.33	42.08	-55.3%	137.97	127.92	-7.9%	46.5	34.3	-12.2
04/20/17	Calibration	33.35	28.07	-18.8%	18.26	17.72	-3.0%	33.8	28.1	-5.7
04/21/17	Validation	33.85	29.61	-14.3%	28.58	30.50	6.3%	34.5	28.9	-5.6
05/13/17	Validation	59.23	40.38	-46.7%	161.84	152.24	-6.3%	44.8	33.6	-11.2
05/25/17	Calibration	42.88	33.57	-27.7%	82.70	80.26	-3.0%	37.6	30.7	-6.9
05/31/17	Calibration	32.91	33.09	0.5%	7.08	7.63	7.2%	34.1	30.5	-3.5
06/16/17	Calibration	27.03	26.96	-0.3%	9.43	10.81	12.7%	30.3	27.5	-2.7
06/17/17	Validation	28.04	25.11	-11.7%	19.91	17.85	-11.5%	30.9	23.8	-7.1
06/23/17	Calibration	50.87	36.32	-40.0%	57.41	62.87	8.7%	39.8	31.8	-8.0
07/07/17	Calibration	46.34	36.68	-26.4%	45.72	48.11	5.0%	39.7	32.0	-7.7
07/22/17	Validation	33.37	31.33	-6.5%	17.62	20.59	14.4%	34.0	29.7	-4.2
07/24/17	Calibration	42.19	34.85	-21.1%	49.49	57.43	13.8%	38.3	31.3	-7.0
Averages		41.3	33.2	-24.5%	53.3	52.4	-1.7%	36.9	30.1	-6.8

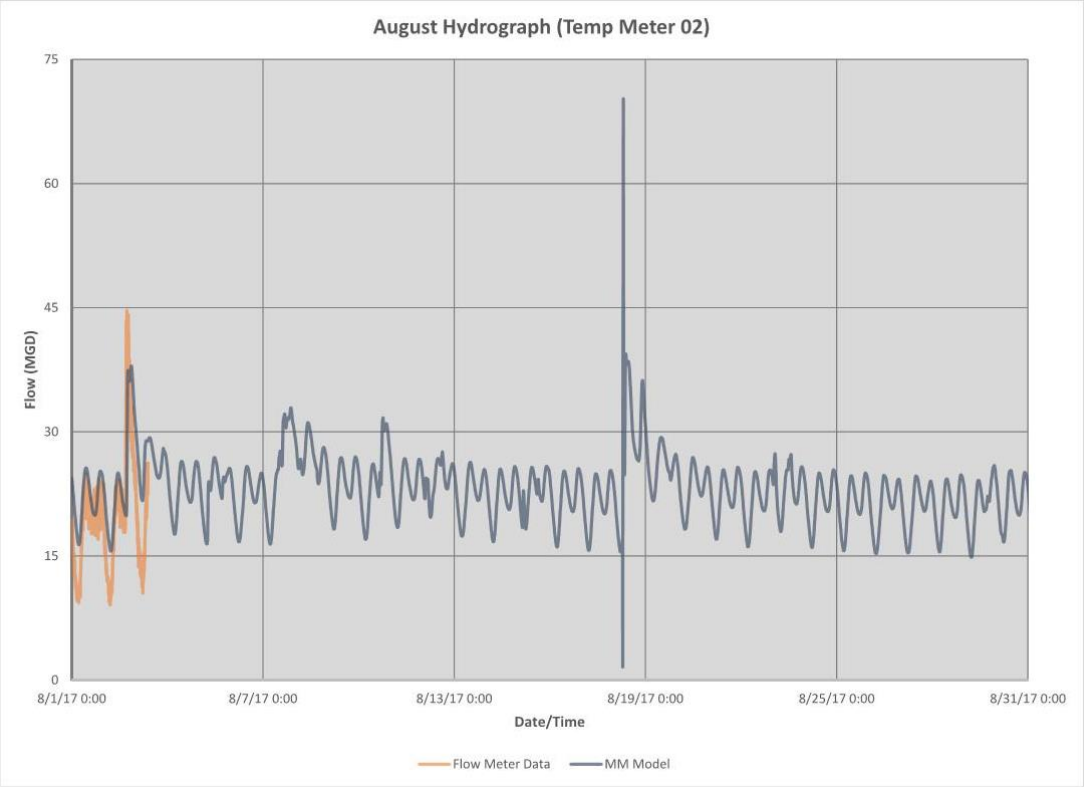


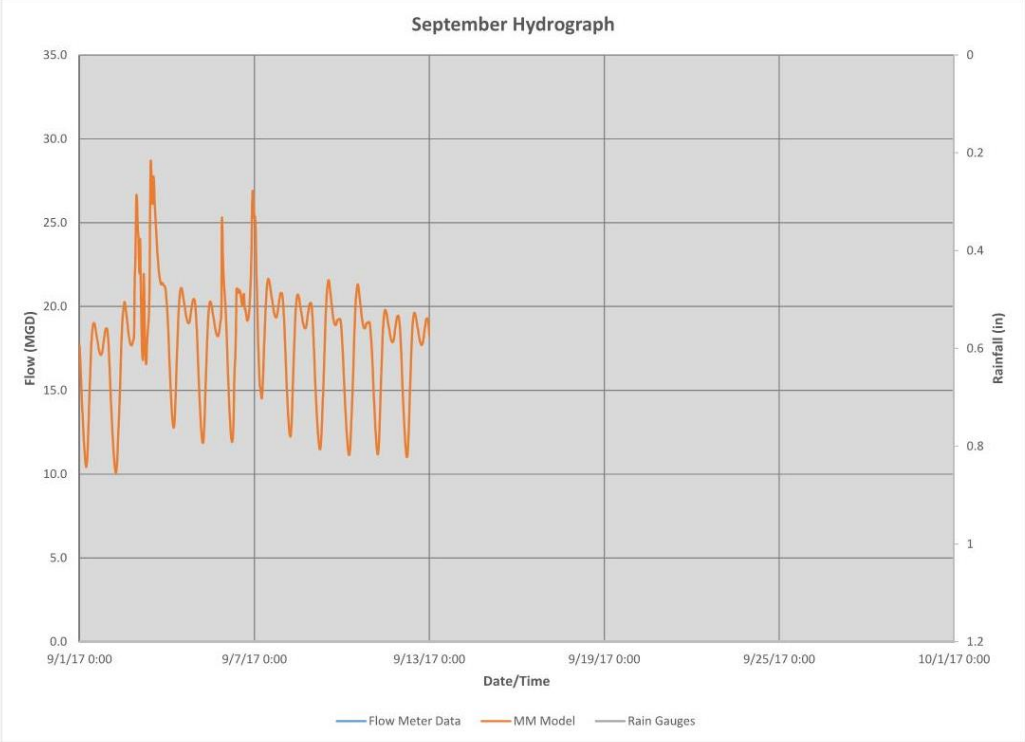

April Hydrograph (Temp Meter 02)
75
60
45
30
15
0
Flow (MGD)
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

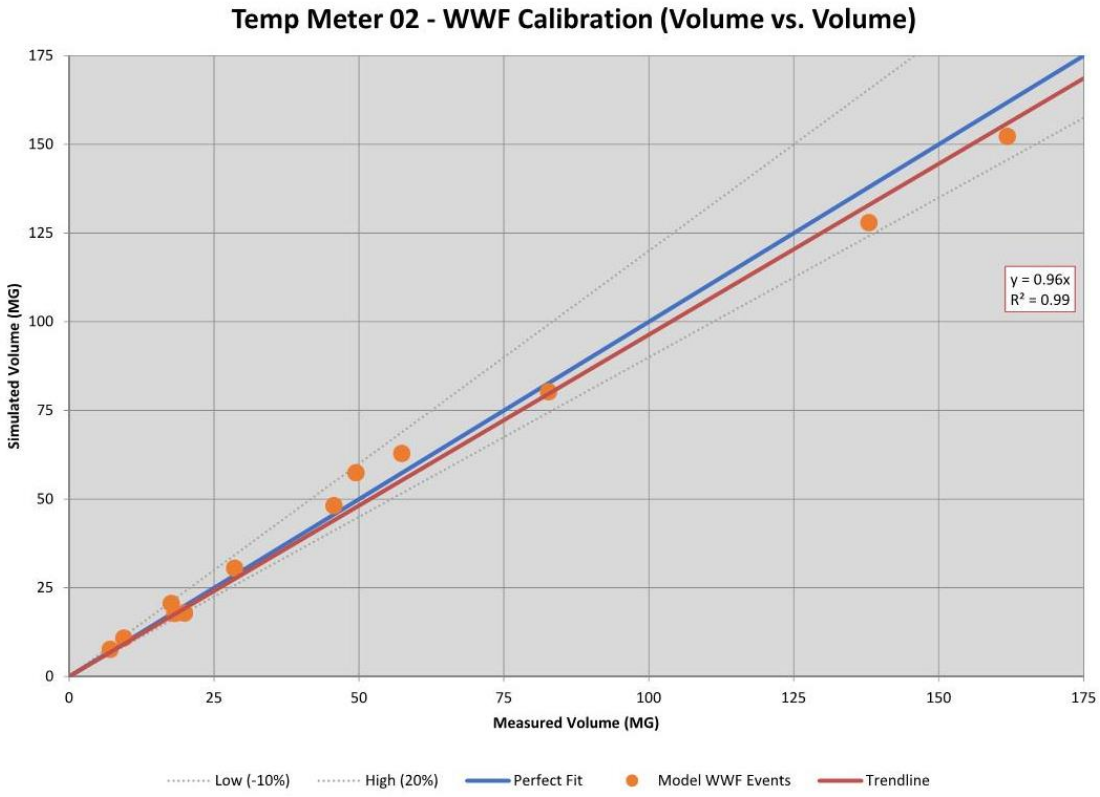

May Hydrograph (Temp Meter 02)
100
80
60
40
20
0
Flow (MGD)
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 02)
100
80
60
40
20
0
Flow (MGD)
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 02)
75
60
45
30
15
0
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model
Rain Gauges


August Hydrograph (Temp Meter 02)
75
60
45
30
15
0
Flow (MGD)
8/1/17 0:00
8/7/17 0:00
8/13/17 0:00
8/19/17 0:00
8/25/17 0:00
8/31/17 0:00
Date/Time
Flow Meter Data
MM Model


September Hydrograph
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Flow (MGD)
0
0.2
0.4
0.6
0.8
1
1.2
Rainfall (in)
9/1/17 0:00
9/7/17 0:00
9/13/17 0:00
9/19/17 0:00
9/25/17 0:00
10/1/17 0:00
Date/Time
Flow Meter Data
MM Model
Rain Gauges


Temp Meter 02 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 0.96x
R² = 0.99
0
25
50
75
100
125
150
175
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

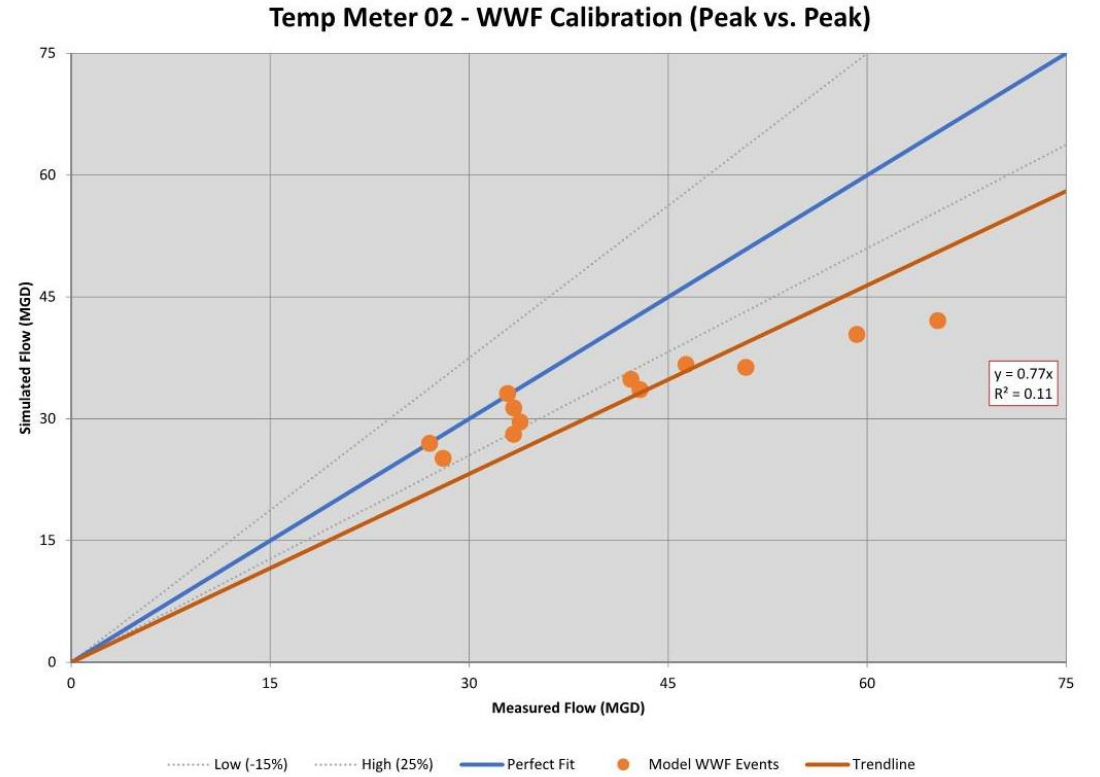
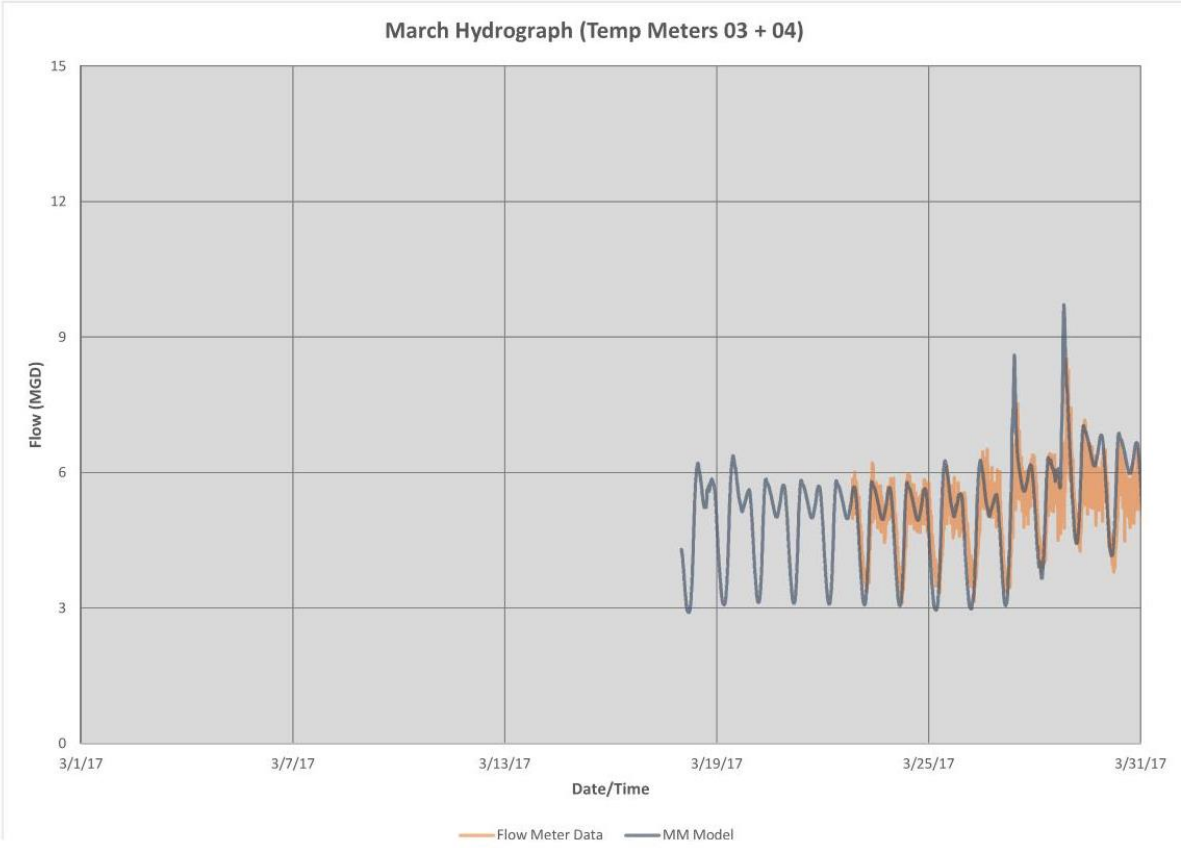
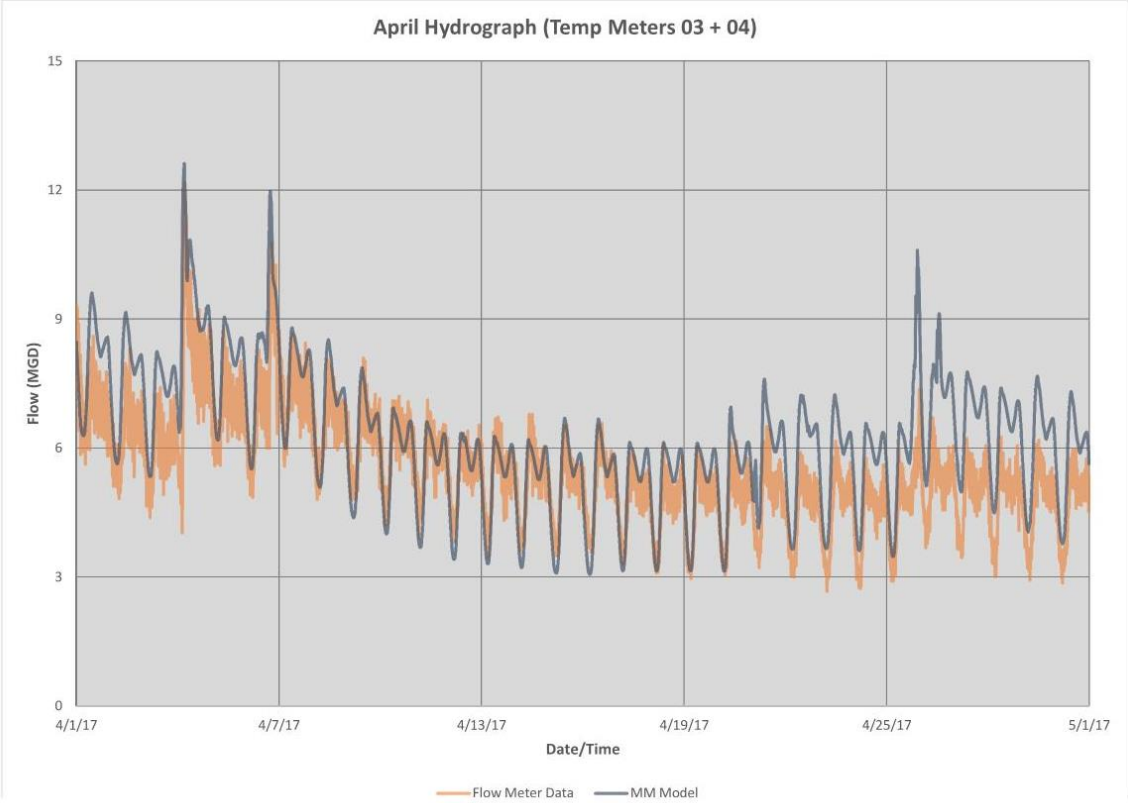
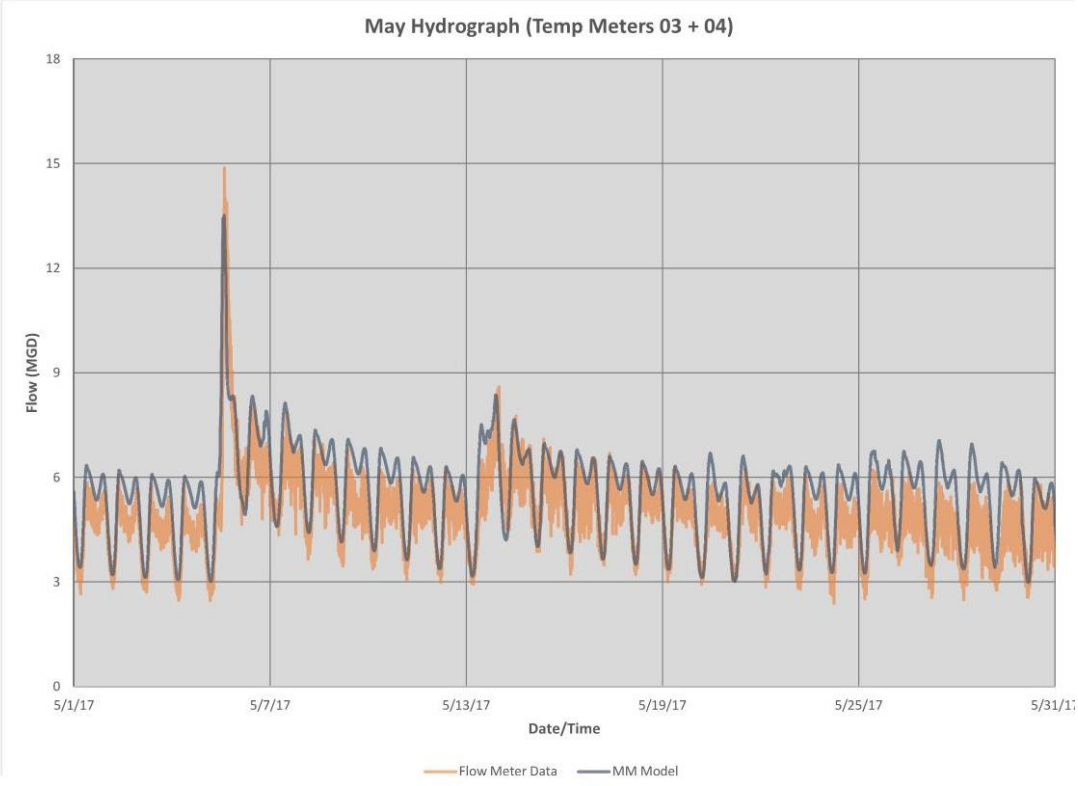

Temp Meter 02 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.77x
R² = 0.11
0
15
30
45
60
75
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

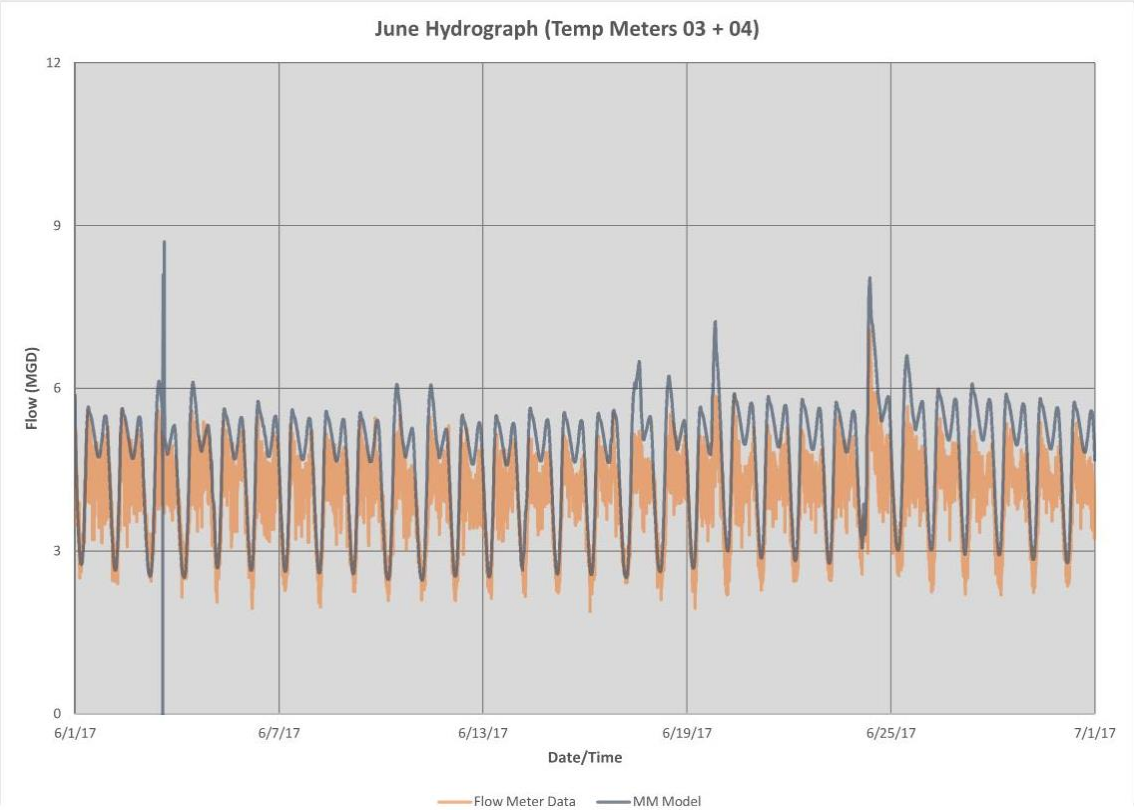
Table 8-11 Temp Meter 03 & 04 WW Flow Statistics

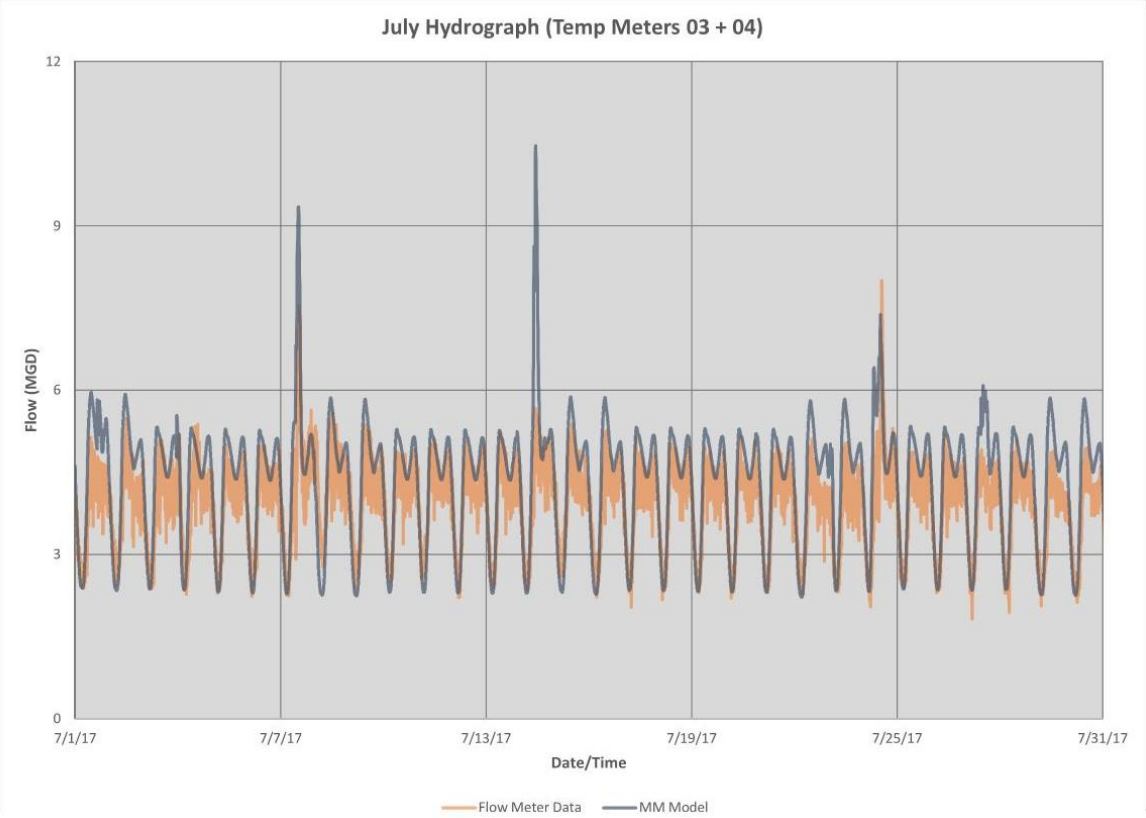
Storm Date	Type	Temp Meters 03 + 04 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	9.69	10.66	9.1%	24.92	29.49	15.5%	0.0	0.0	0.0
04/20/17	Calibration	6.16	6.95	11.3%	3.60	4.17	13.6%	0.0	0.0	0.0
04/21/17	Validation	6.50	7.60	14.5%	5.62	6.85	18.0%	0.0	0.0	0.0
05/13/17	Validation	8.60	8.37	-2.8%	28.19	30.43	7.4%	0.0	0.0	0.0
05/25/17	Calibration	6.21	7.06	12.1%	13.79	16.74	17.6%	0.0	0.0	0.0
05/31/17	Calibration	5.91	6.58	10.2%	1.23	1.43	13.8%	0.0	0.0	0.0
06/16/17	Calibration	5.53	5.60	1.2%	1.86	2.10	11.3%	0.0	0.0	0.0
06/17/17	Validation	4.81	5.28	8.8%	3.57	4.02	11.4%	0.0	0.0	0.0
06/23/17	Calibration	7.07	8.03	12.0%	9.65	11.70	17.5%	0.0	0.0	0.0
07/07/17	Calibration	7.55	9.34	19.2%	8.28	8.68	4.6%	0.0	0.0	0.0
07/22/17	Validation	5.04	5.84	13.8%	3.00	3.58	16.2%	0.0	0.0	0.0
07/24/17	Calibration	8.00	7.38	-8.4%	8.72	9.68	9.9%	0.0	0.0	0.0
08/07/17	Calibration	5.42	6.58	17.6%	7.23	8.10	10.8%	0.0	0.0	0.0
08/15/17	Calibration	5.13	5.22	1.9%	4.17	4.54	8.2%	0.0	0.0	0.0
08/18/17	Validation	14.29	11.35	-25.9%	8.90	8.90	0.0%	0.0	0.0	0.0
Averages		7.1	7.5	5.3%	9.4	10.8	13.0%			

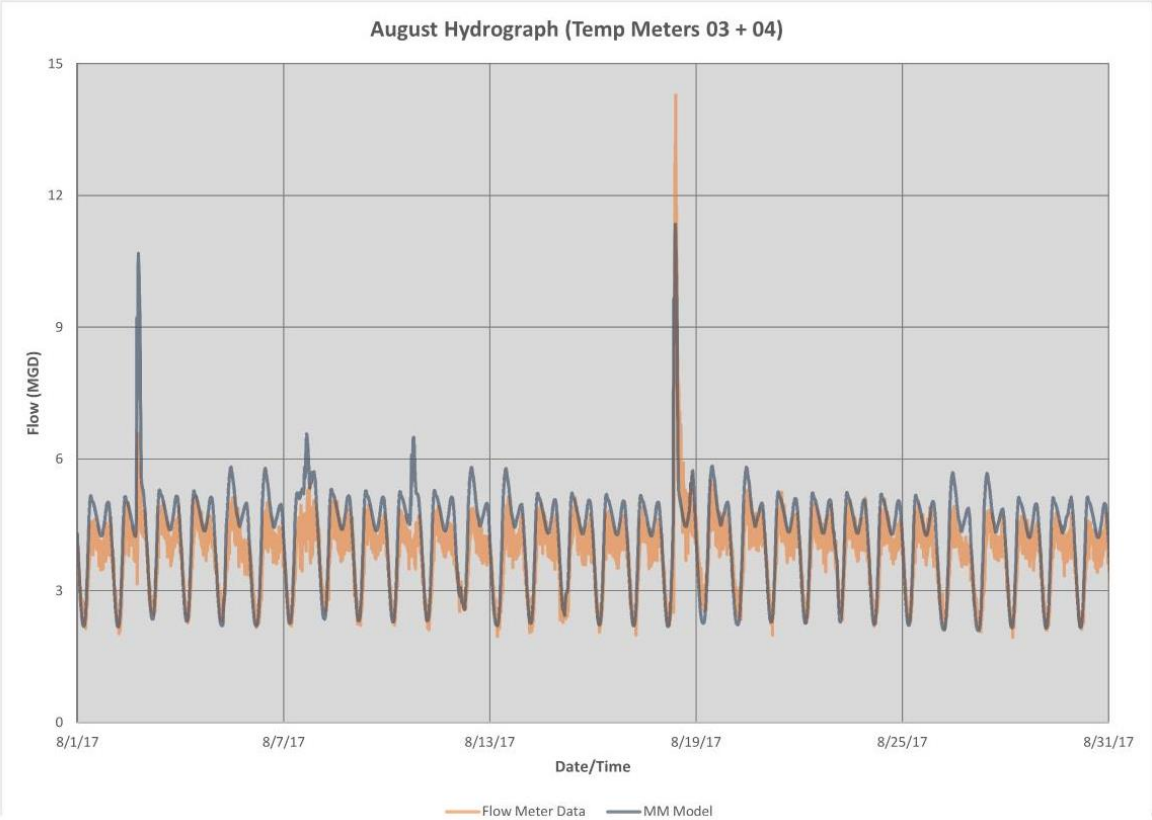


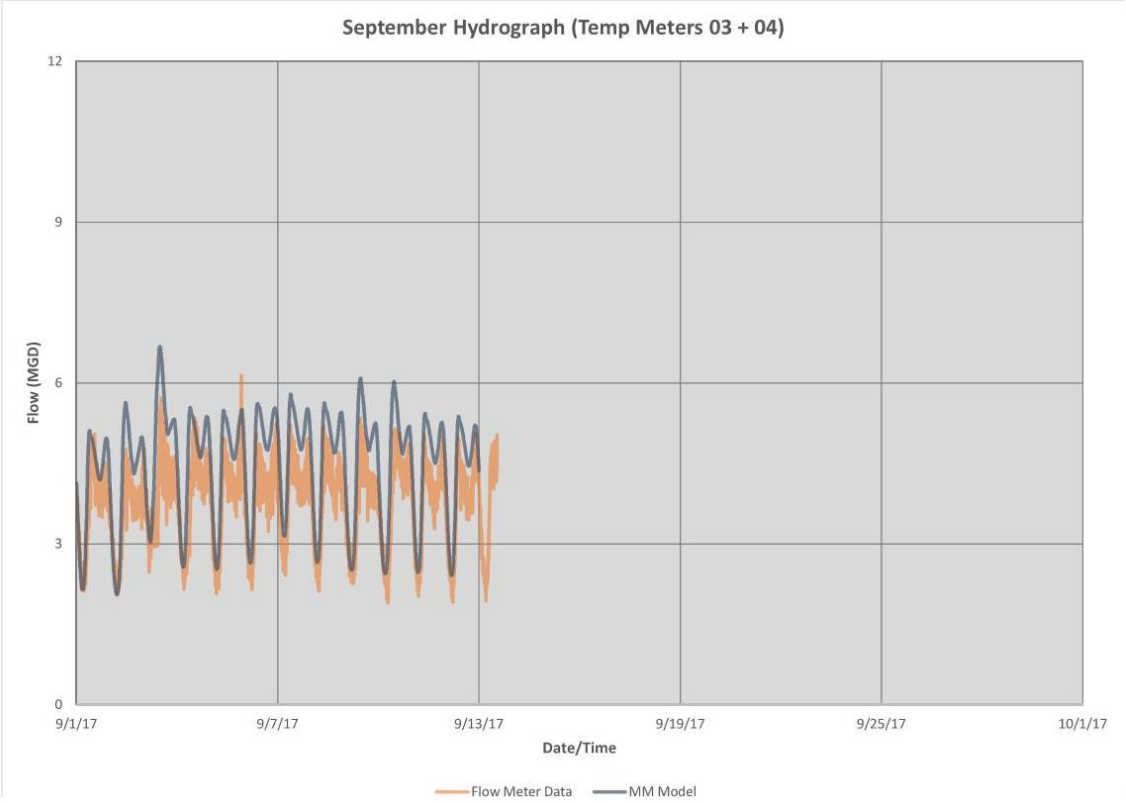

April Hydrograph (Temp Meters 03 + 04)
Flow (MGD)
15
12
9
6
3
0
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

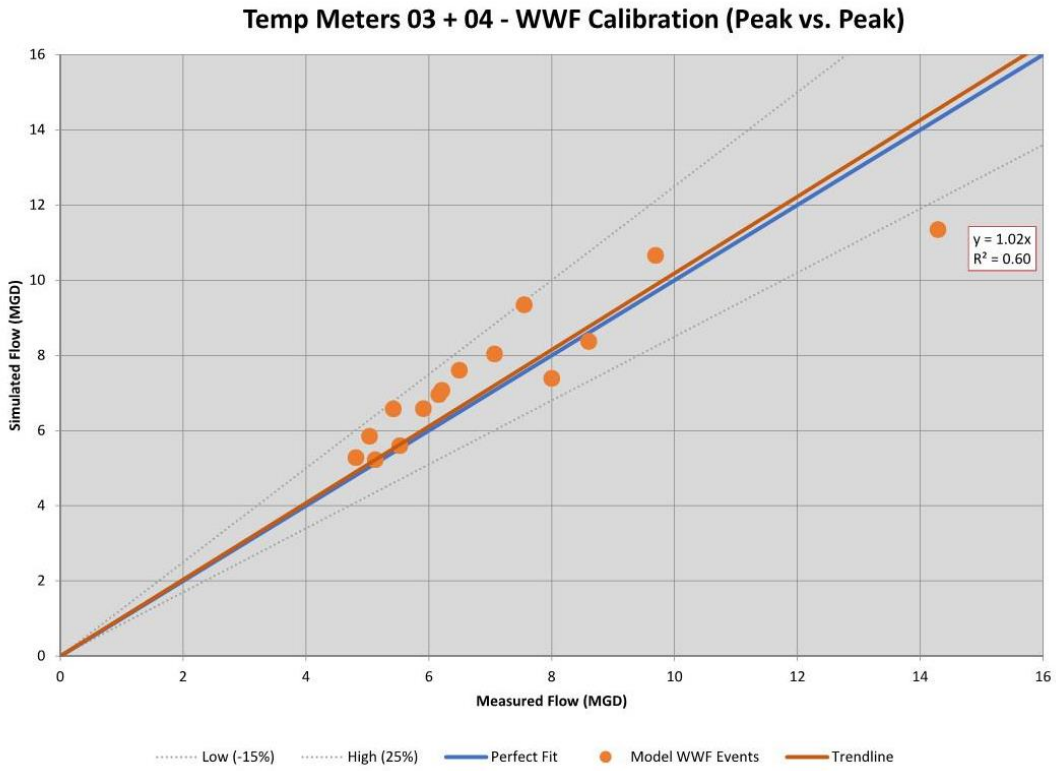

May Hydrograph (Temp Meters 03 + 04)
Flow (MGD)
18
15
12
9
6
3
0
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meters 03 + 04)
12
9
6
3
0
Flow (MGD)
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meters 03 + 04)
12
9
6
3
0
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meters 03 + 04)
Flow (MGD)
15
12
9
6
3
0
8/1/17
8/7/17
8/13/17
8/19/17
8/25/17
8/31/17
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meters 03 + 04)
Flow (MGD)
12
9
6
3
0
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meters 03 + 04 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 1.02x
R² = 0.60
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

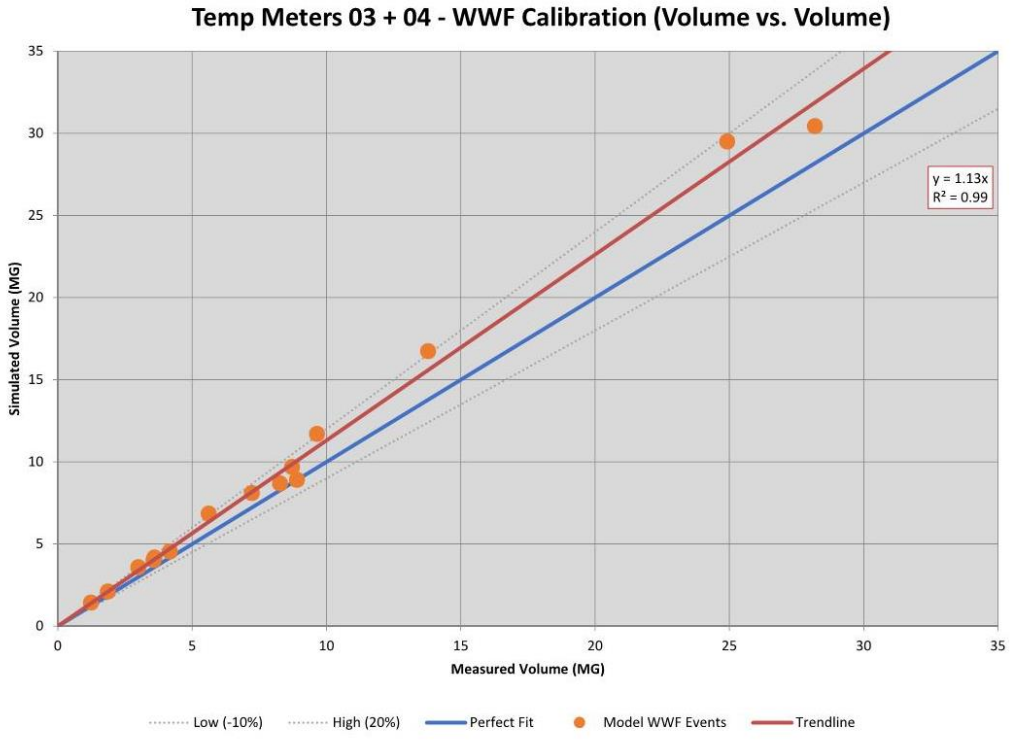
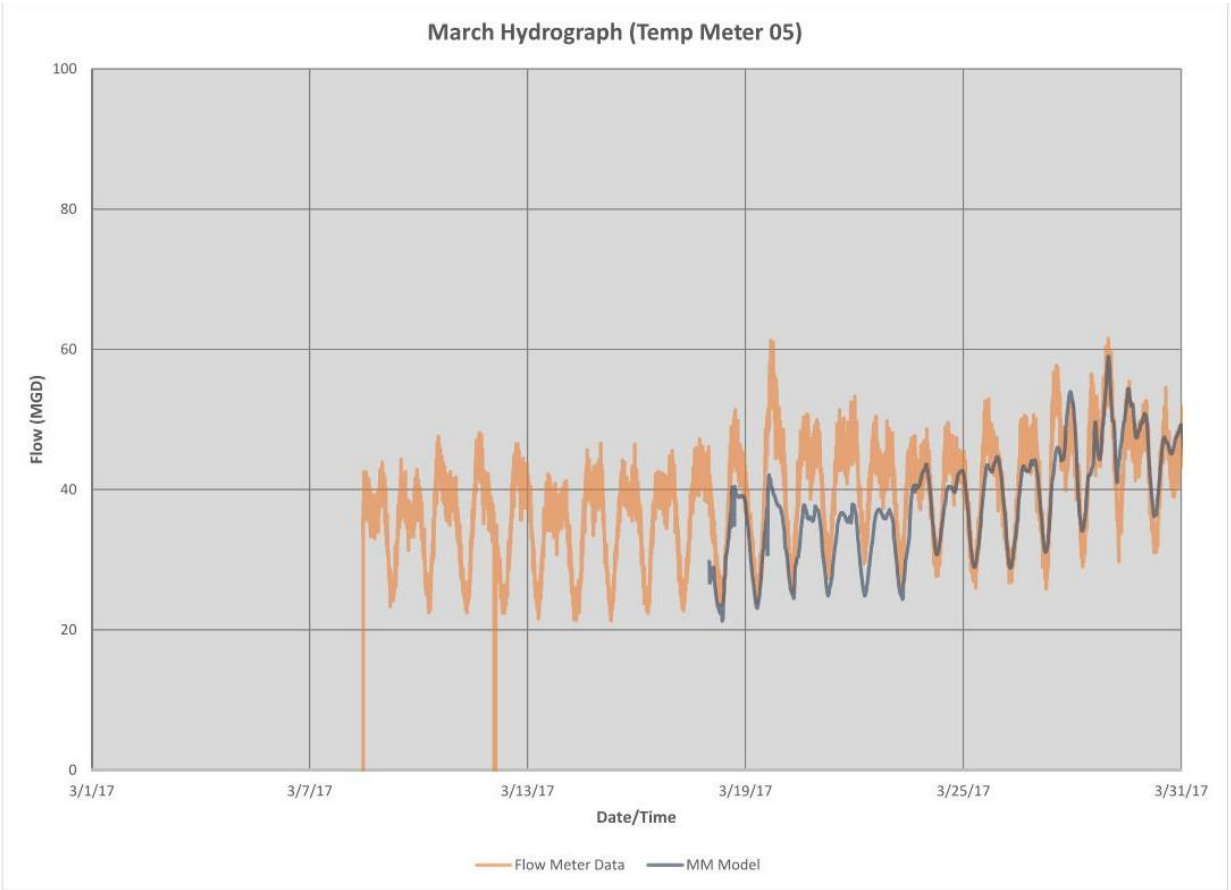
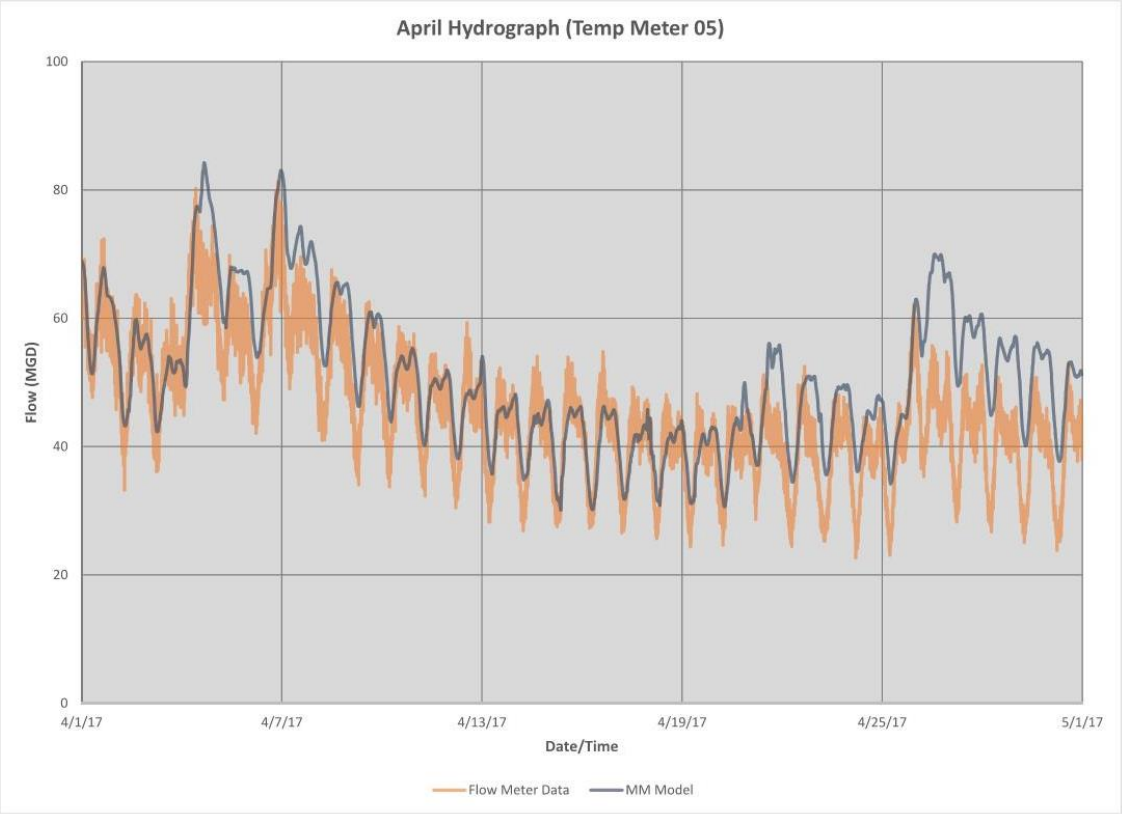
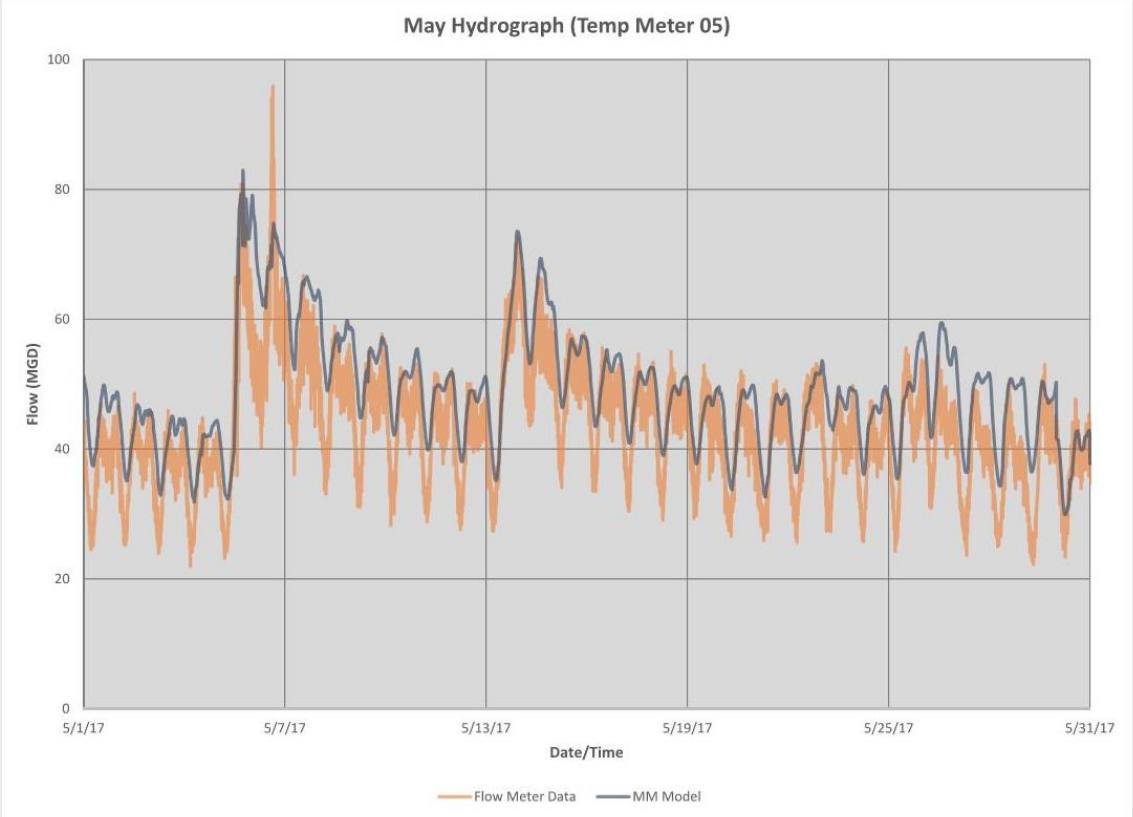

Temp Meters 03 + 04 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 1.13x
R² = 0.99
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

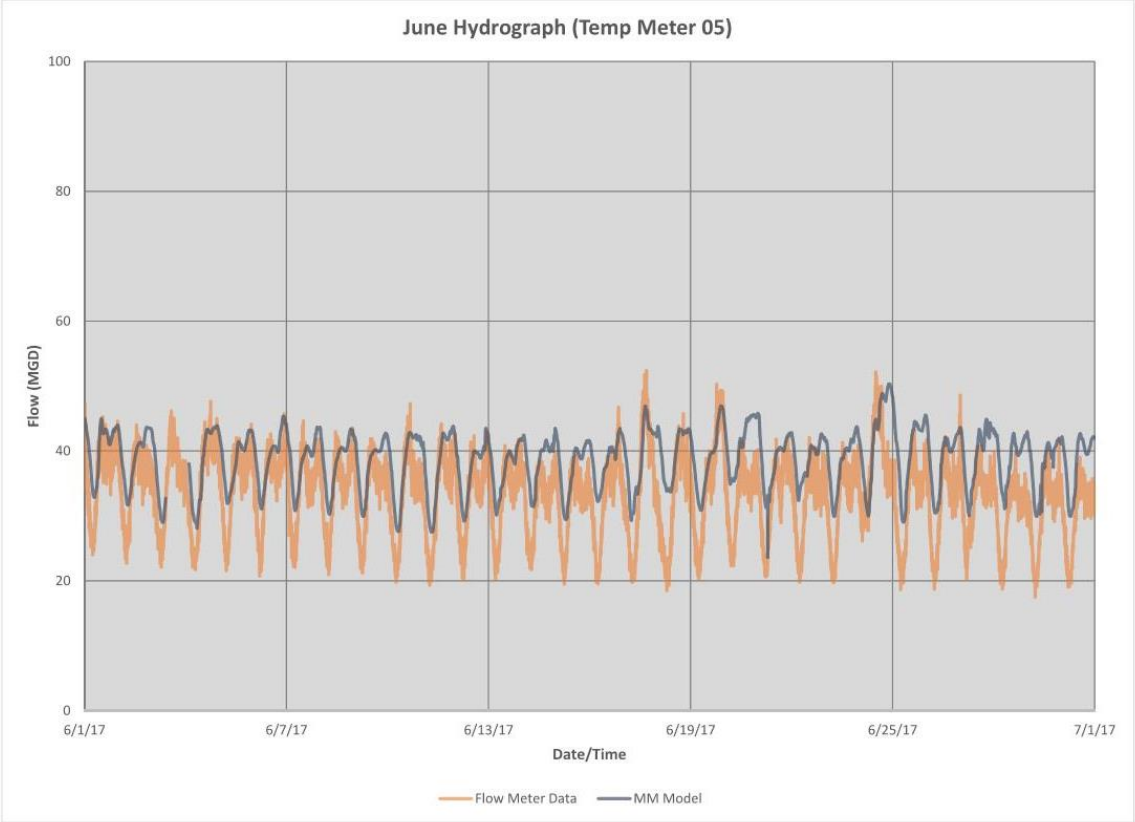
Table 8-12 Temp Meter 05 WW Statistics

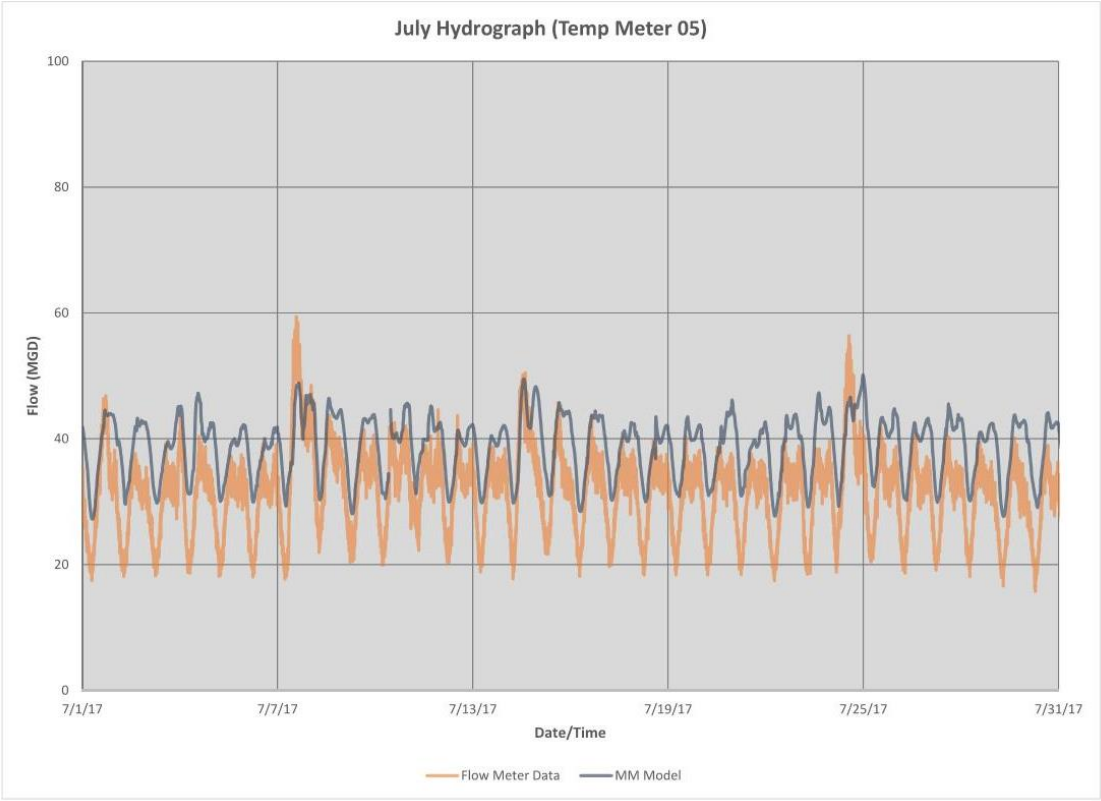
Storm Date	Type	Temp Meter 05 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	73.20	68.88	-6.3%	205.28	210.41	2.4%	57.7	53.6	-4.1
04/20/17	Calibration	46.28	49.99	7.4%	28.55	29.67	3.8%	44.6	46.7	2.1
04/21/17	Validation	51.23	56.10	8.7%	47.83	56.41	15.2%	47.6	48.5	0.9
05/13/17	Validation	72.57	73.56	1.3%	253.89	278.74	8.9%	57.3	55.6	-1.7
05/25/17	Calibration	55.61	59.51	6.6%	124.04	147.37	15.8%	49.0	49.7	0.7
05/31/17	Calibration	47.37	45.11	-5.0%	11.46	12.69	9.7%	45.8	42.4	-3.4
06/16/17	Calibration	46.78	43.49	-7.6%	16.37	18.96	13.6%	45.9	46.8	0.9
06/17/17	Validation	39.42	41.69	5.4%	29.21	33.23	12.1%	42.3	40.0	-2.3
06/23/17	Calibration	52.20	50.37	-3.6%	79.35	94.09	15.7%	49.3	48.3	-1.1
07/07/17	Calibration	59.45	48.89	-21.6%	72.24	78.49	8.0%	52.2	56.4	4.2
07/22/17	Validation	38.88	47.31	17.8%	24.62	31.37	21.5%	42.0	45.4	3.4
07/24/17	Calibration	56.42	50.17	-12.5%	74.65	89.91	17.0%	50.2	48.6	-1.6
08/07/17	Calibration	50.61	45.39	-11.5%	59.18	72.02	17.8%	45.5	50.8	5.3
08/15/17	Calibration	36.68	43.81	16.3%	32.14	43.55	26.2%	40.7	41.2	0.5
08/18/17	Validation	49.16	48.12	-2.2%	65.67	79.37	17.3%	47.0	55.0	8.0
Averages		51.7	51.5	-0.4%	75.0	85.1	11.9%	47.8	48.6	0.8

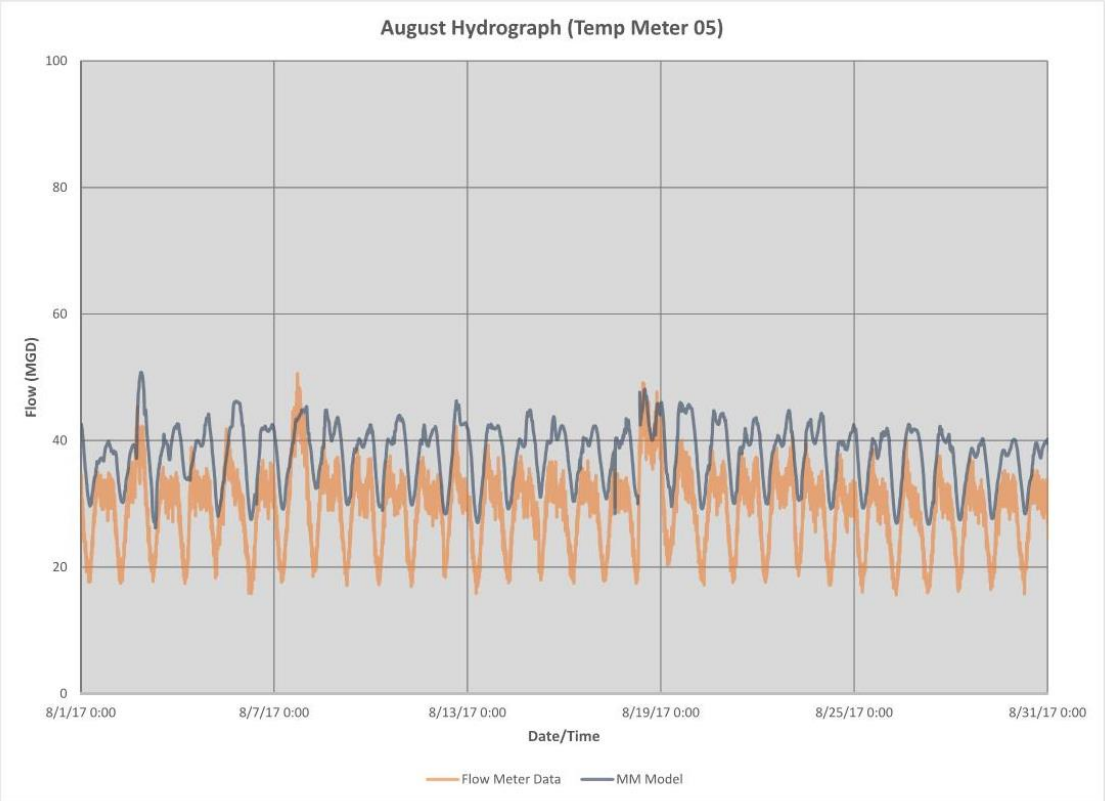


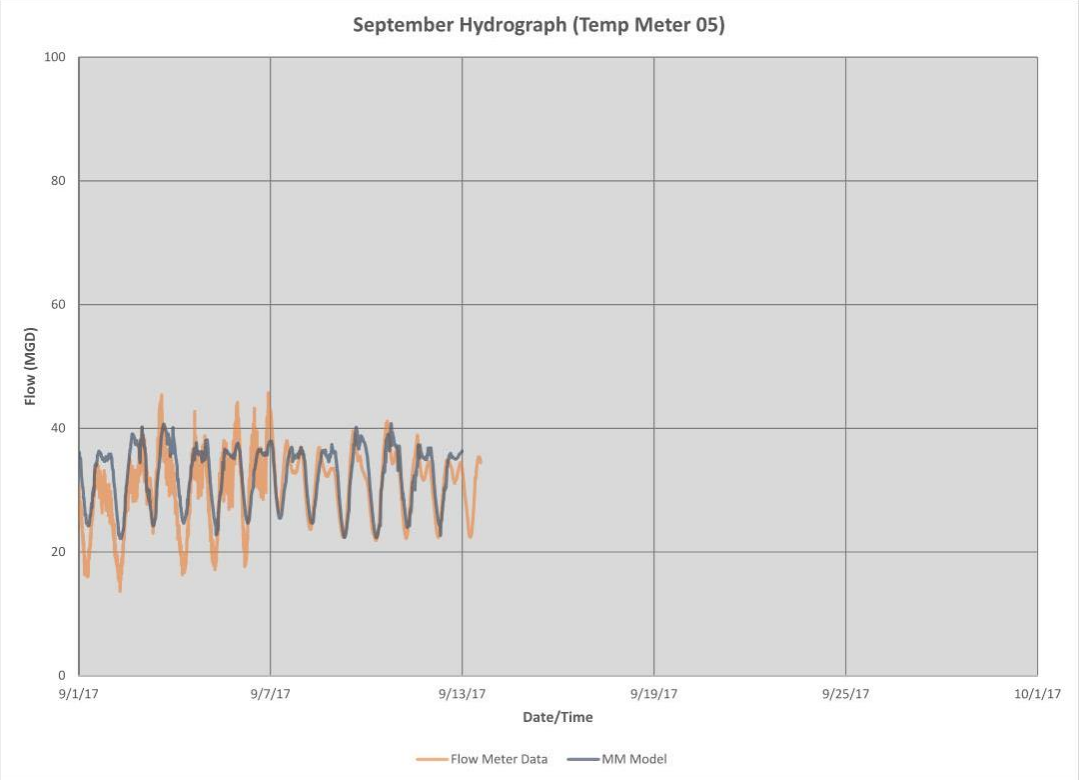

April Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

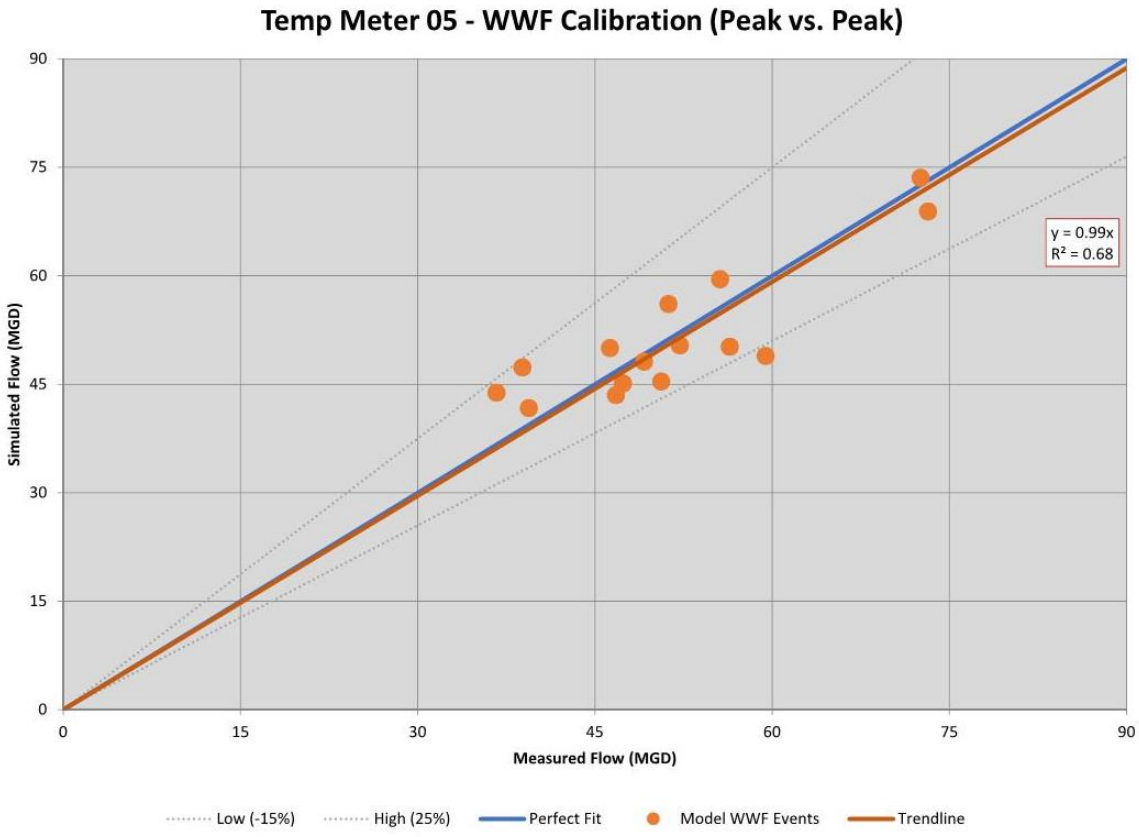

May Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
8/1/17 0:00
8/7/17 0:00
8/13/17 0:00
8/19/17 0:00
8/25/17 0:00
8/31/17 0:00
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meter 05)
100
80
60
40
20
0
Flow (MGD)
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meter 05 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.99x
R² = 0.68
0
15
30
45
60
75
90
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

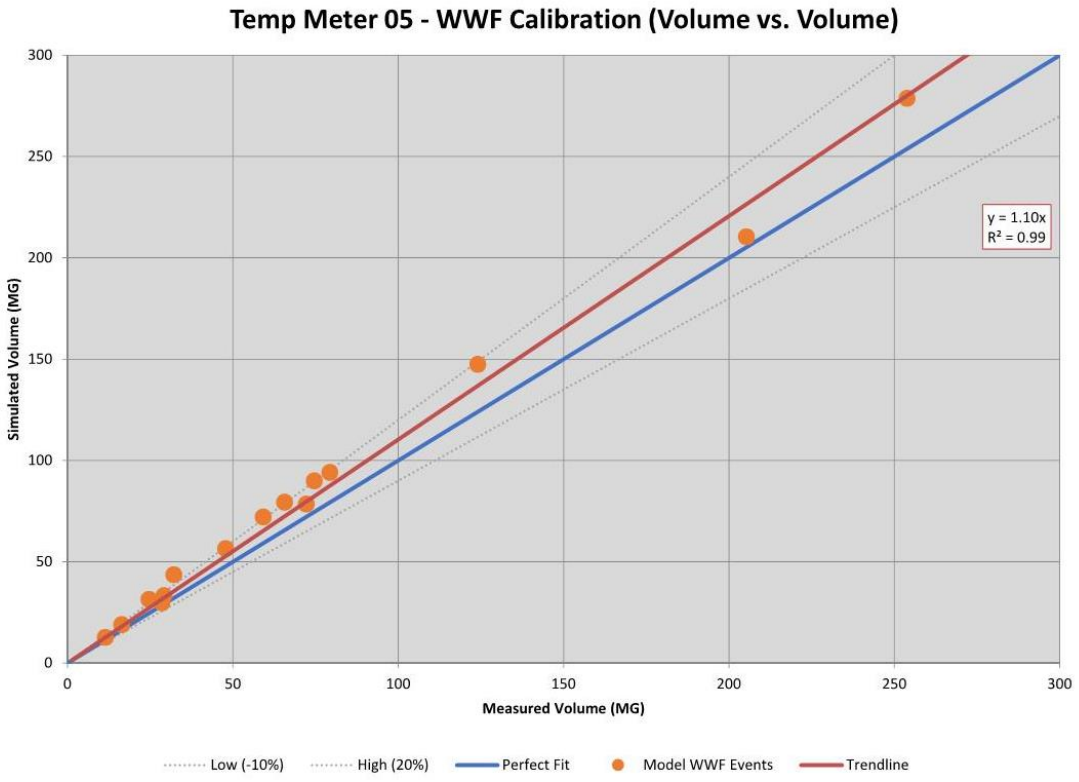
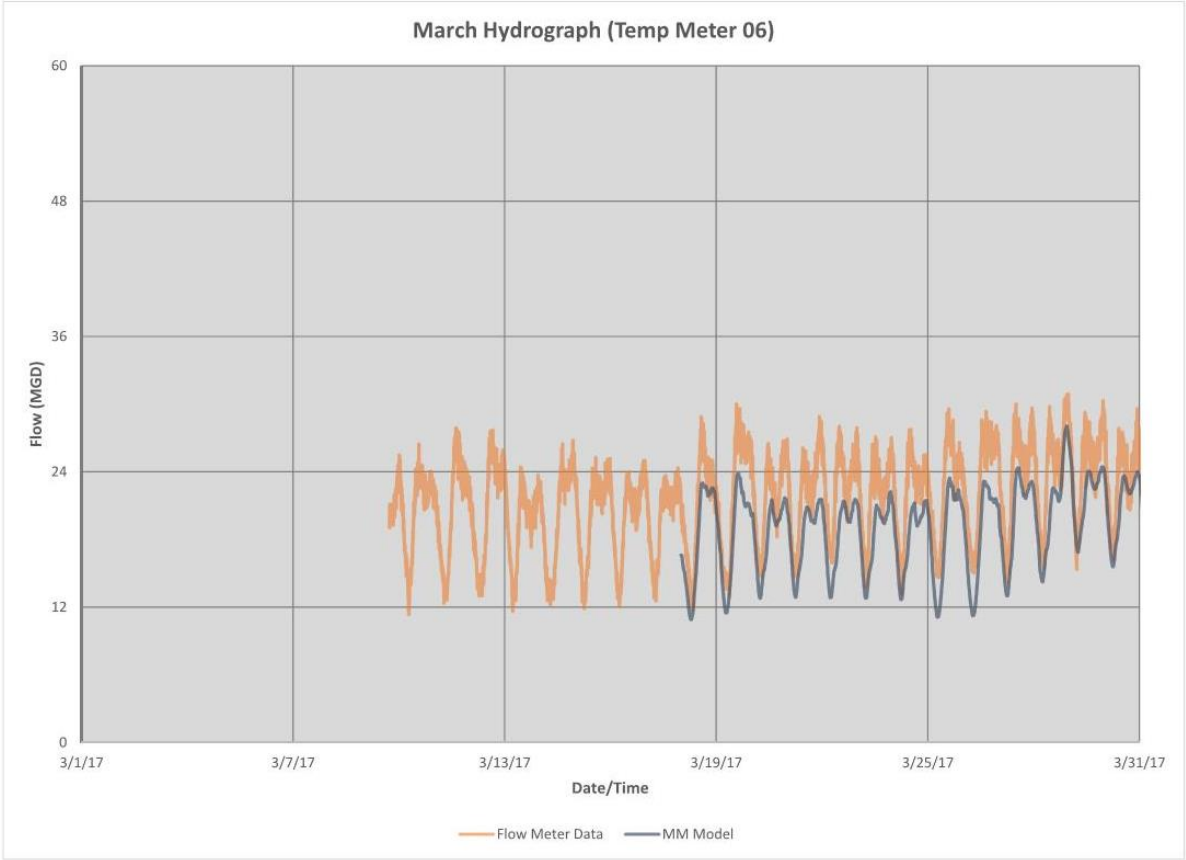
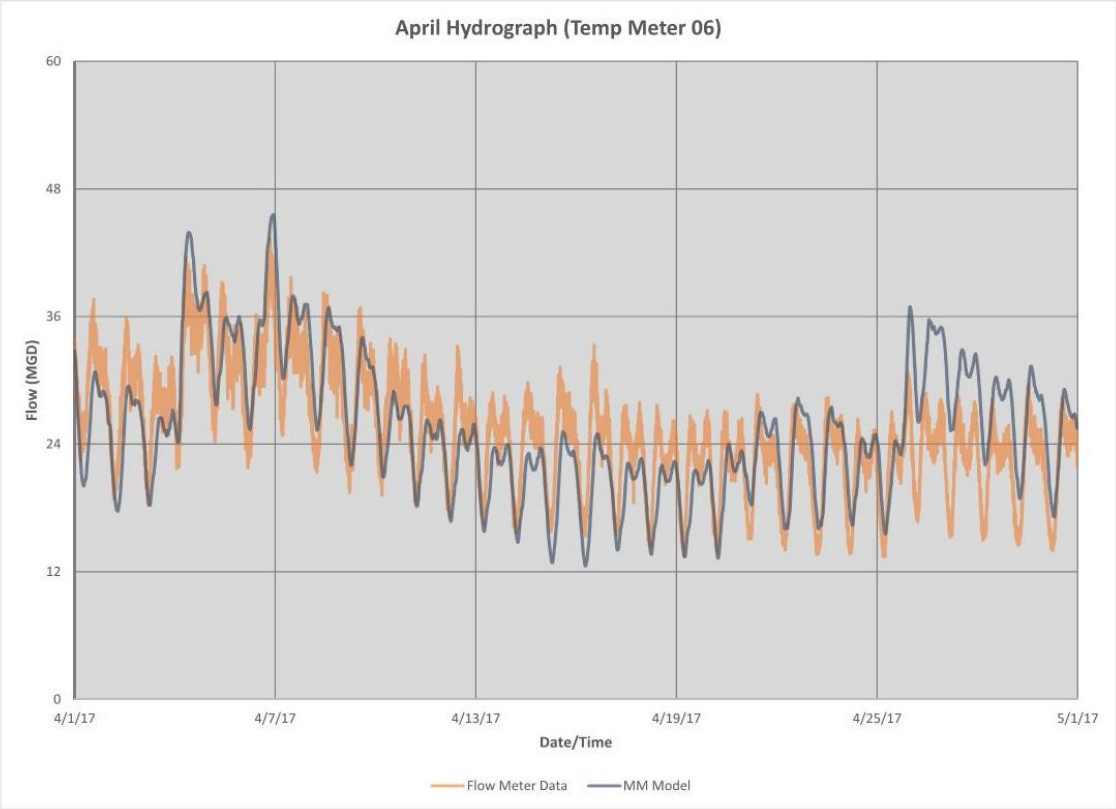
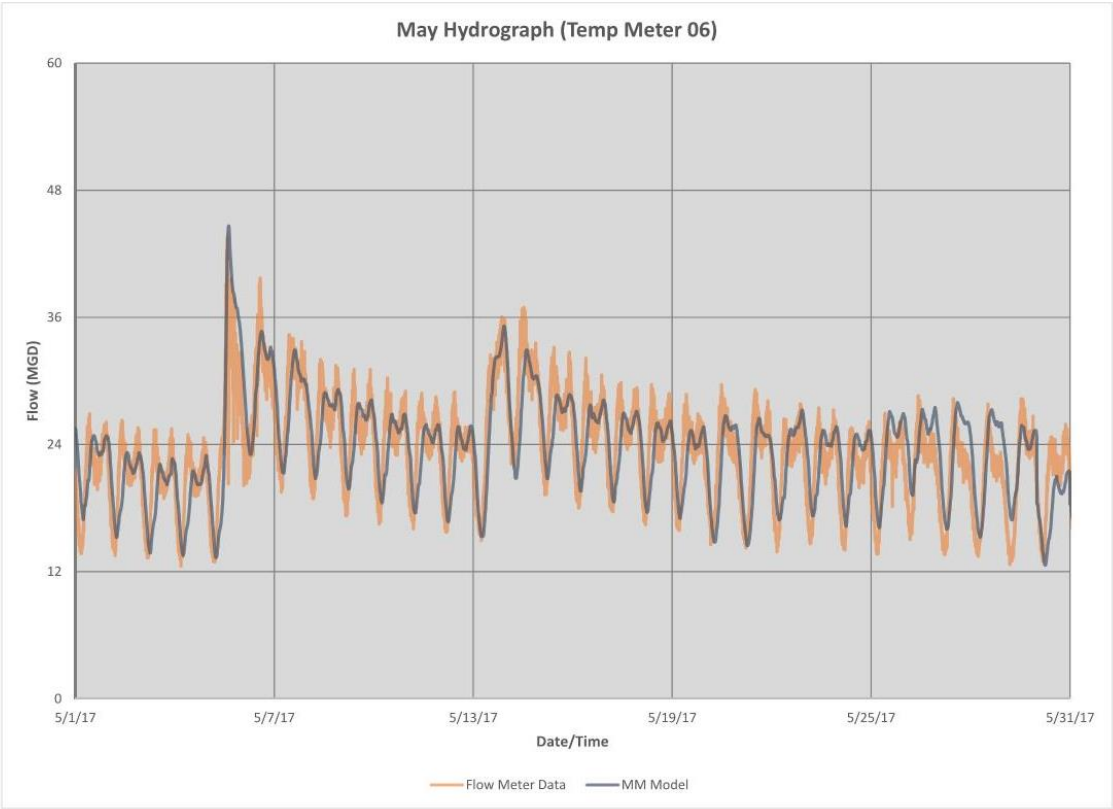

Temp Meter 05 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 1.10x
R² = 0.99
0
50
100
150
200
250
300
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

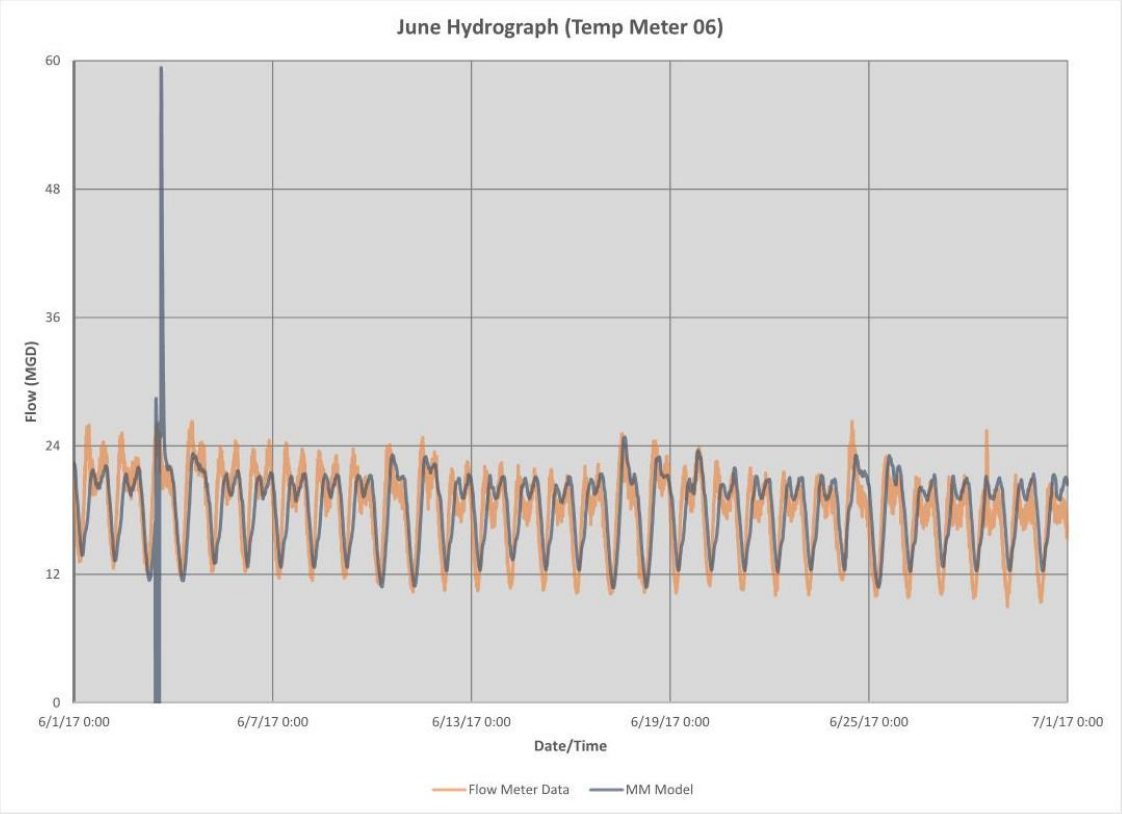
Table 8-13 Temp Meter 06 WW Flow Statistics

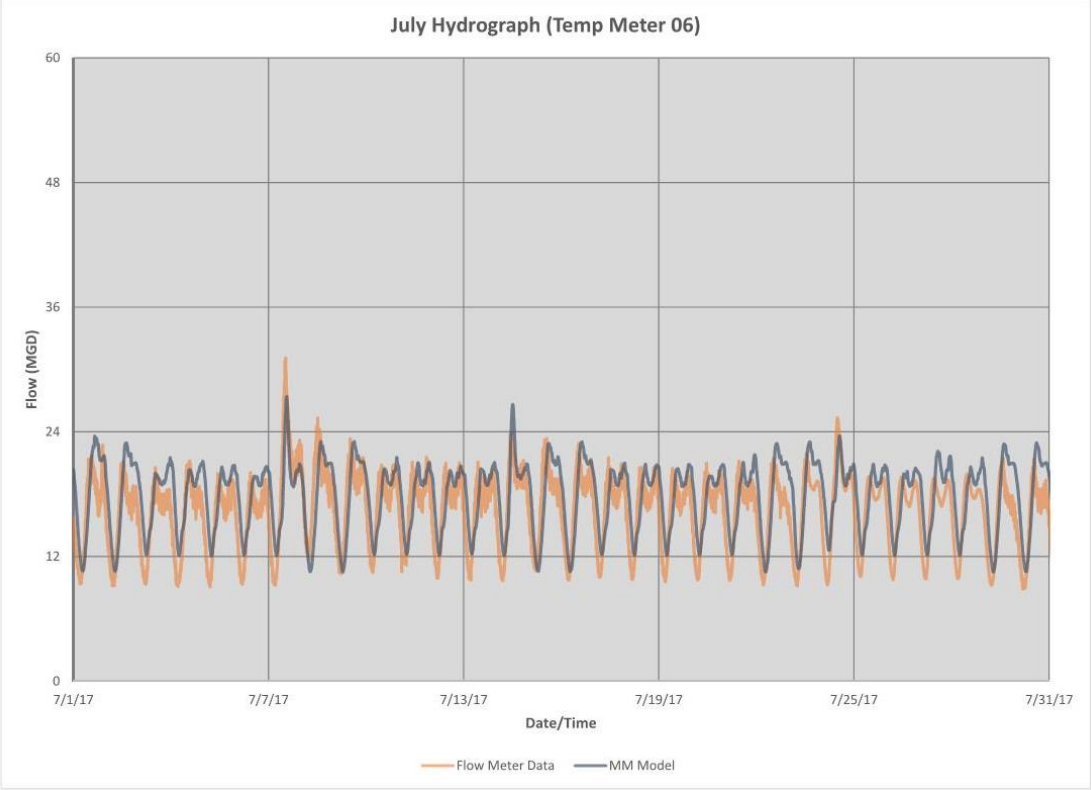
Storm Date	Type	Temp Meter 06 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	37.64	33.59	-12.1%	106.34	96.93	-9.7%	44.9	40.3	-4.5
04/20/17	Calibration	27.08	24.01	-12.8%	16.36	14.92	-9.6%	35.0	33.1	-1.9
04/21/17	Validation	28.69	26.98	-6.3%	25.67	27.82	7.7%	36.2	35.4	-0.8
05/13/17	Validation	36.96	35.18	-5.1%	137.74	134.09	-2.7%	43.8	41.7	-2.1
05/25/17	Calibration	28.62	27.96	-2.4%	64.87	70.77	8.3%	35.5	36.0	0.5
05/31/17	Calibration	25.82	23.34	-10.6%	5.81	6.12	5.1%	33.6	32.6	-1.1
06/16/17	Calibration	22.31	21.40	-4.3%	8.07	9.01	10.4%	30.7	31.2	0.4
06/17/17	Validation	22.35	20.36	-9.8%	17.20	16.16	-6.4%	31.6	27.5	-4.1
06/23/17	Calibration	26.30	23.14	-13.7%	39.82	42.24	5.7%	33.6	32.5	-1.2
07/07/17	Calibration	31.12	27.39	-13.6%	36.57	34.99	-4.5%	37.9	35.5	-2.4
07/22/17	Validation	21.93	23.03	4.8%	12.71	14.28	11.1%	30.7	32.4	1.7
07/24/17	Calibration	25.36	23.62	-7.4%	36.60	39.75	7.9%	34.7	32.8	-1.9
08/07/17	Calibration	20.48	22.37	8.5%	27.91	33.37	16.4%	29.9	31.8	1.9
08/15/17	Calibration	18.53	20.80	10.9%	16.40	19.63	16.4%	28.7	30.8	2.1
08/18/17	Validation	21.23	25.62	17.1%	31.13	35.43	12.1%	31.0	34.2	3.2
Totals		26.3	25.3	-4.1%	38.9	39.7	2.1%	34.5	33.8	-0.7

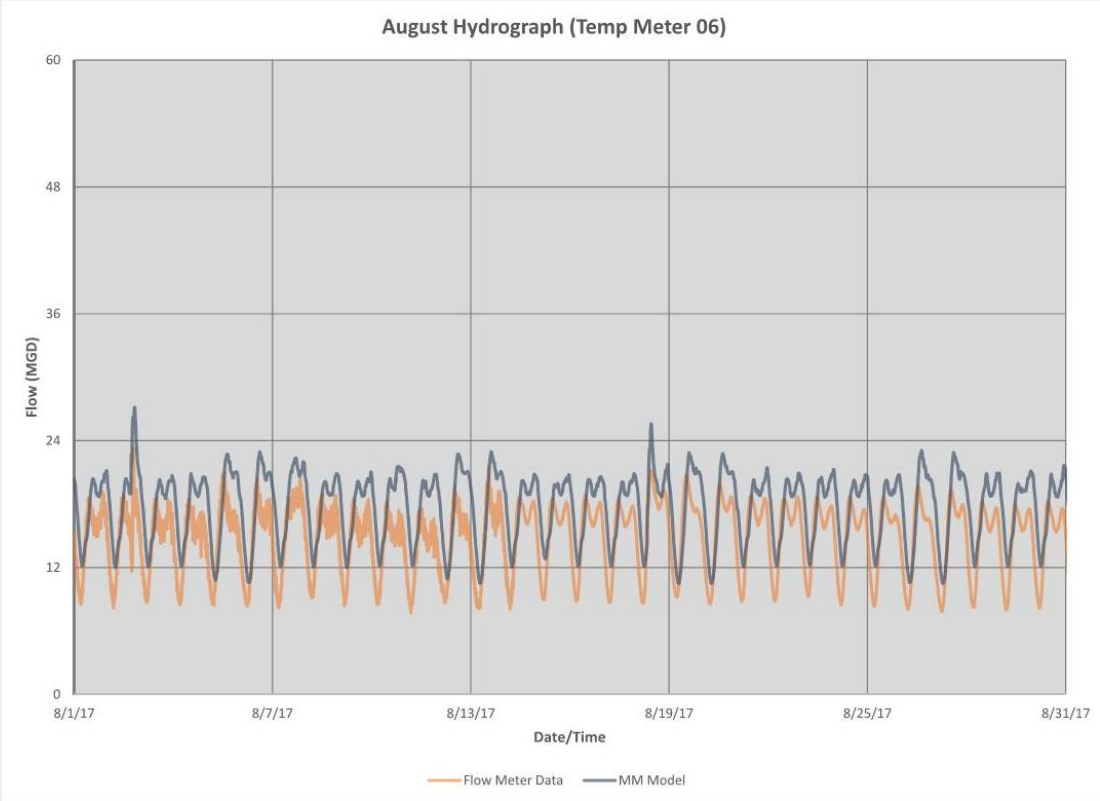


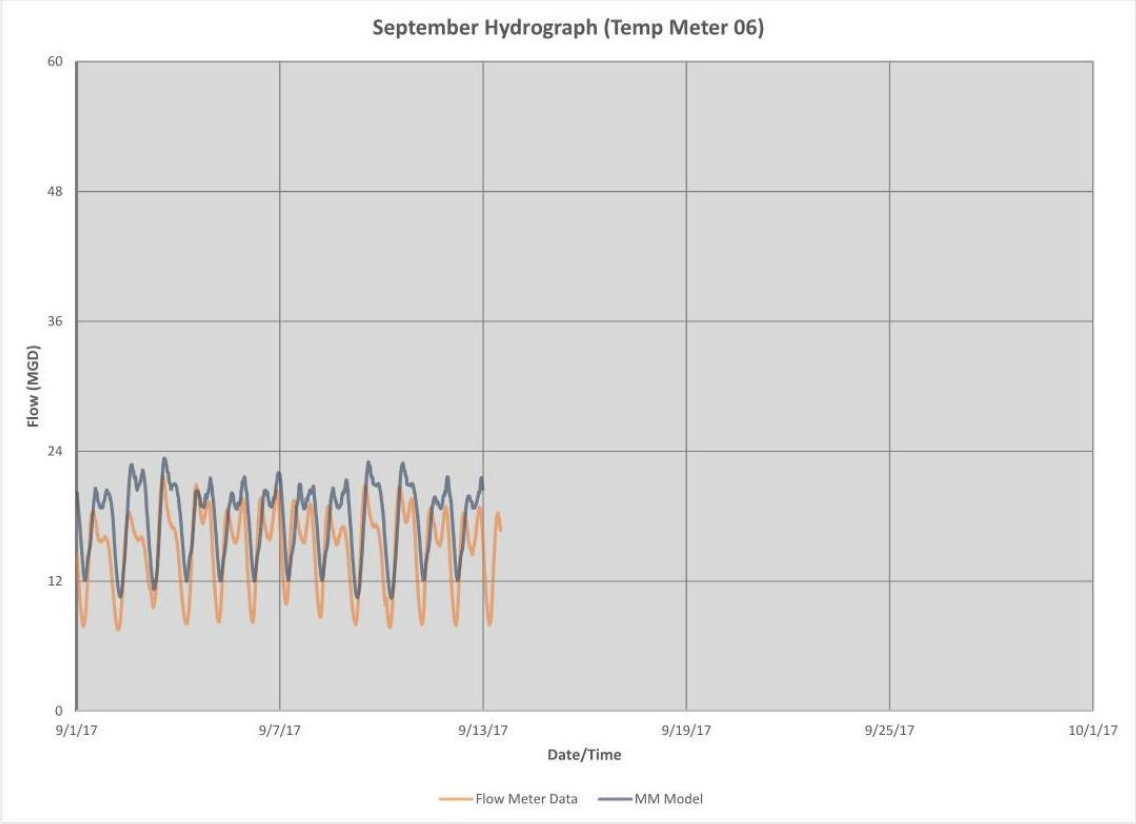

April Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

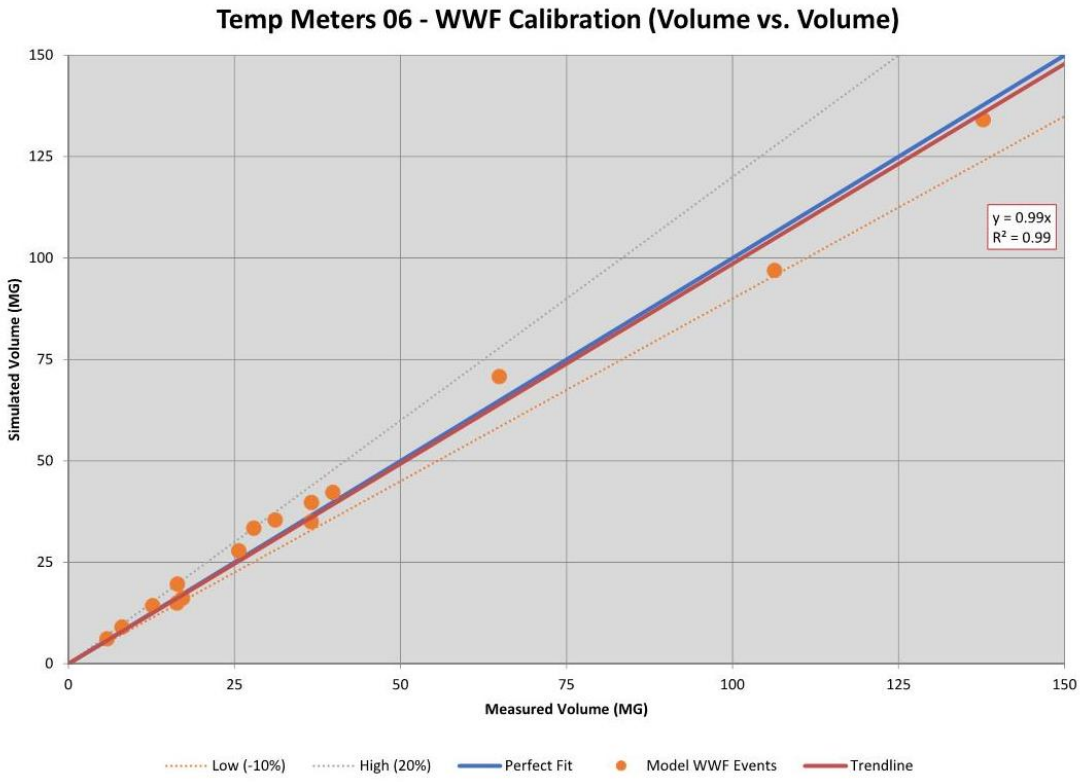

May Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
6/1/17 0:00
6/7/17 0:00
6/13/17 0:00
6/19/17 0:00
6/25/17 0:00
7/1/17 0:00
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
8/1/17
8/7/17
8/13/17
8/19/17
8/25/17
8/31/17
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meter 06)
60
48
36
24
12
0
Flow (MGD)
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meters 06 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 0.99x
R² = 0.99
0
25
50
75
100
125
150
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

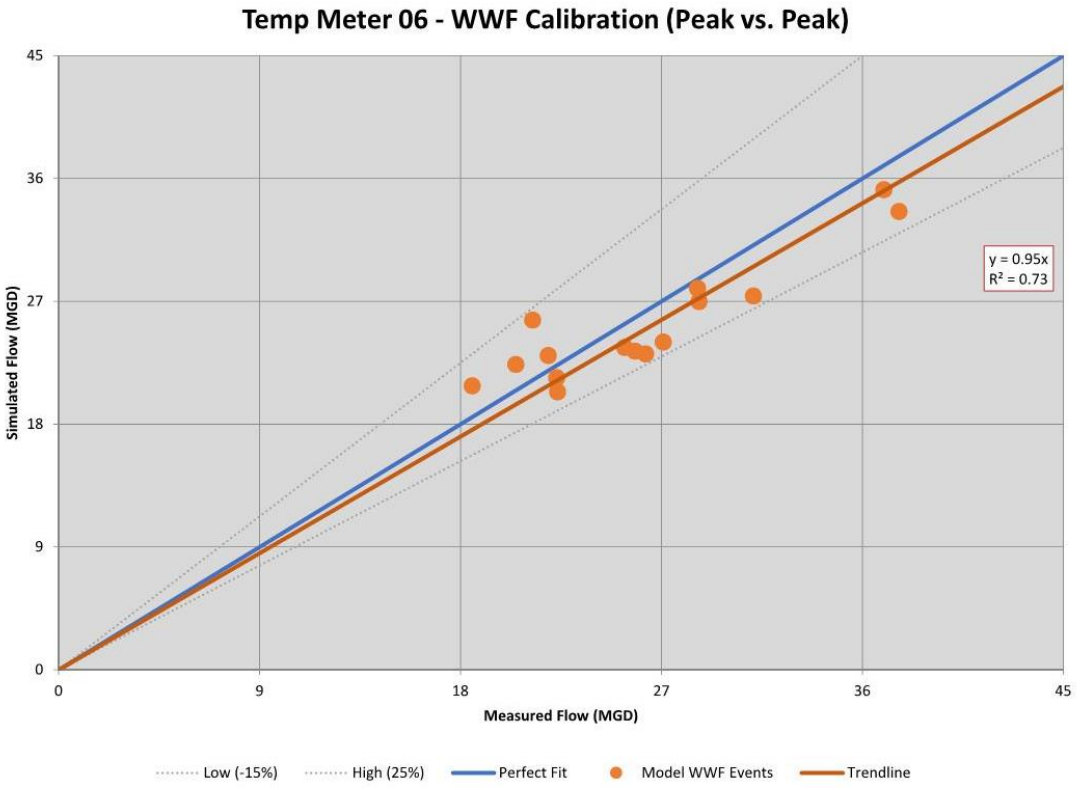
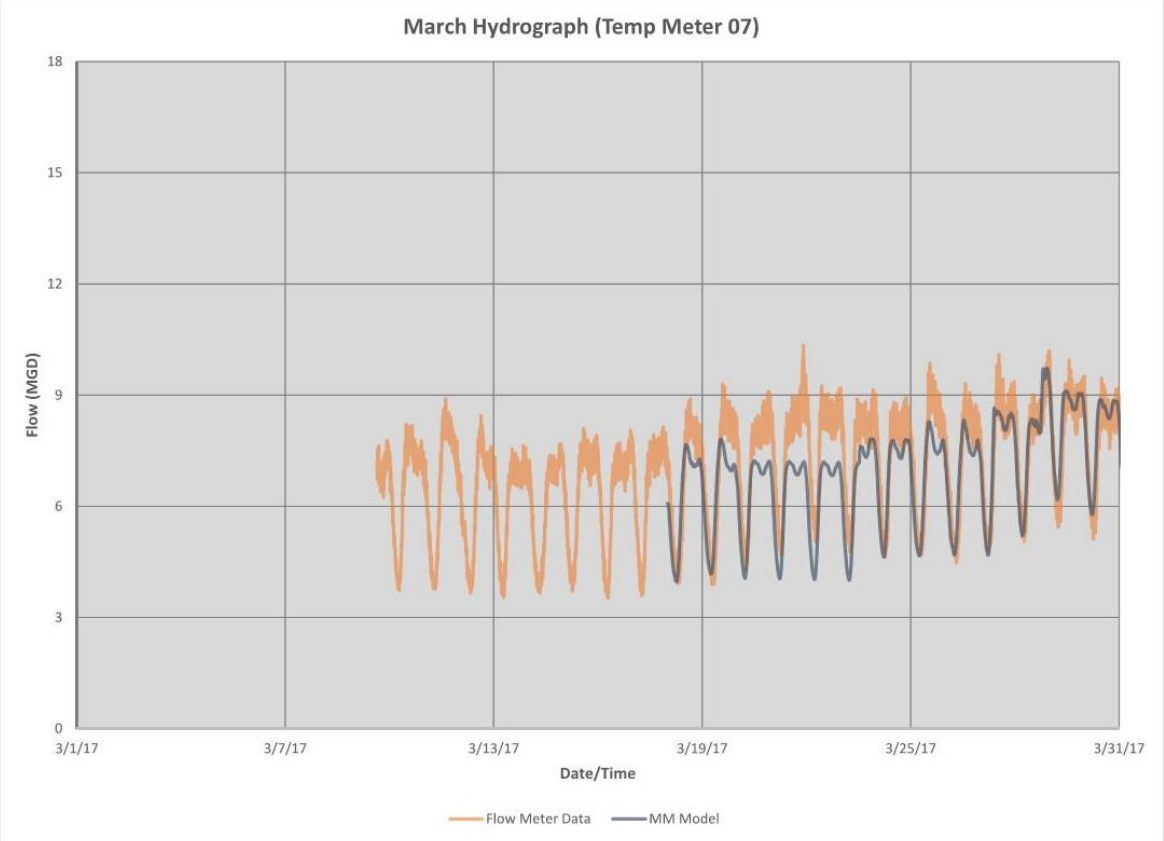
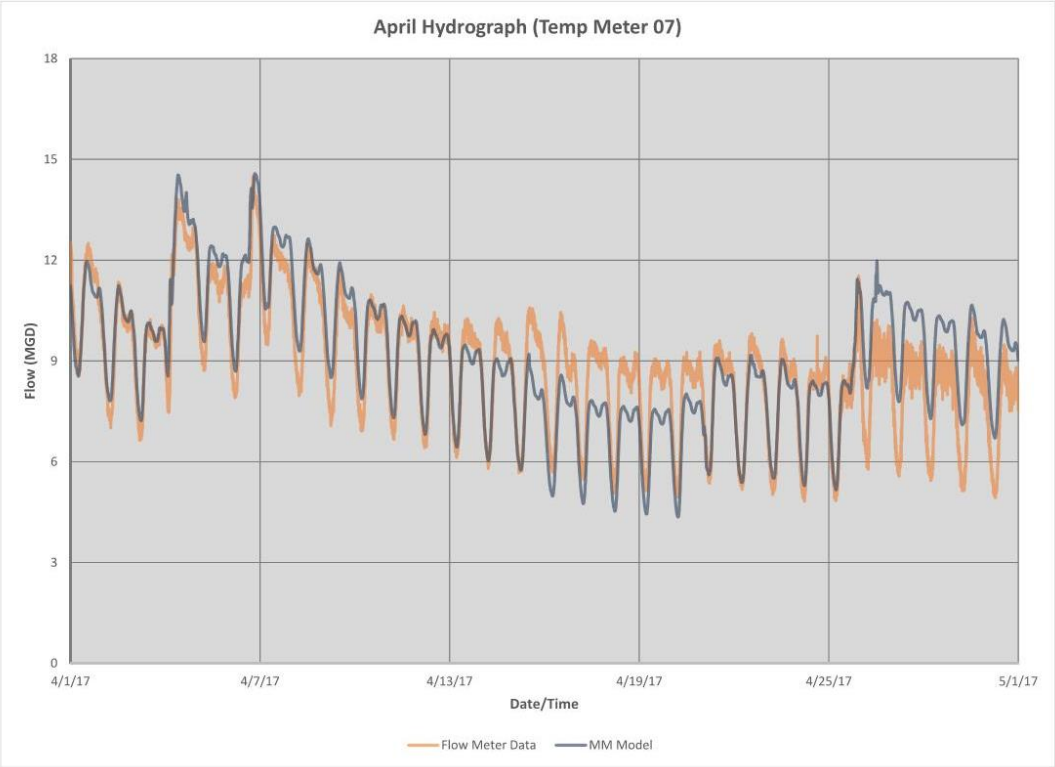
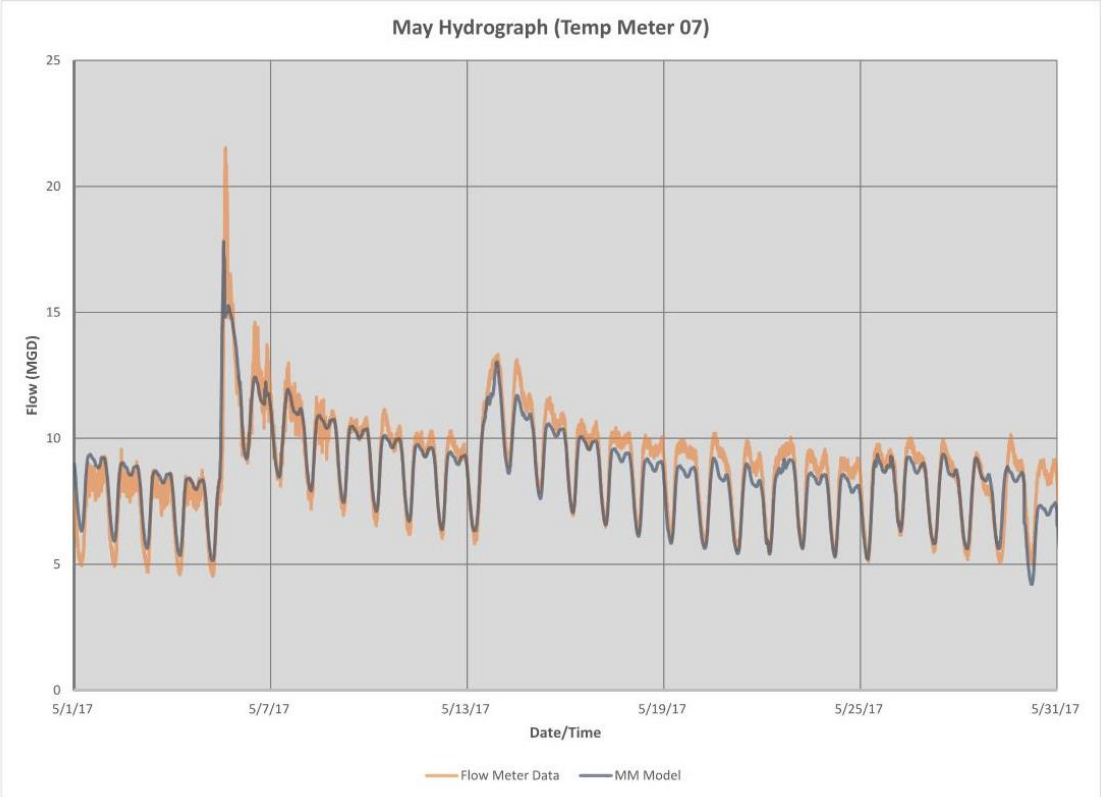

Temp Meter 06 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.95x
R² = 0.73
0
9
18
27
36
45
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

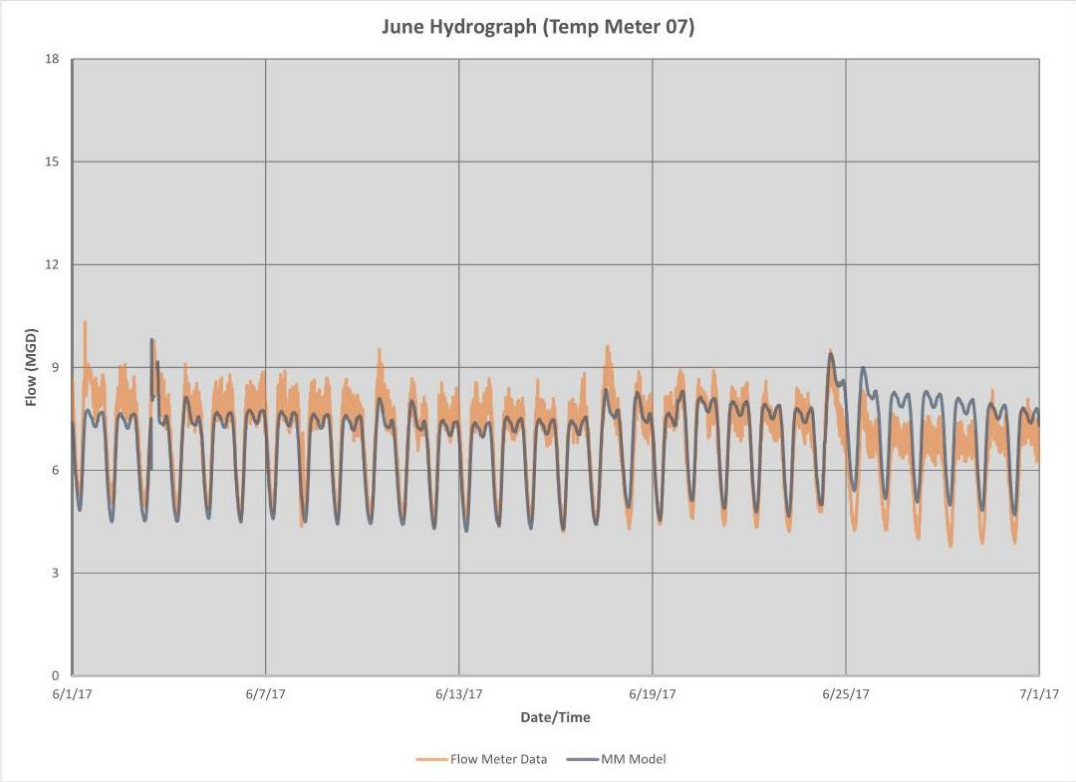
Table 8-14 Temp Meter 07 WW Flow Statistics

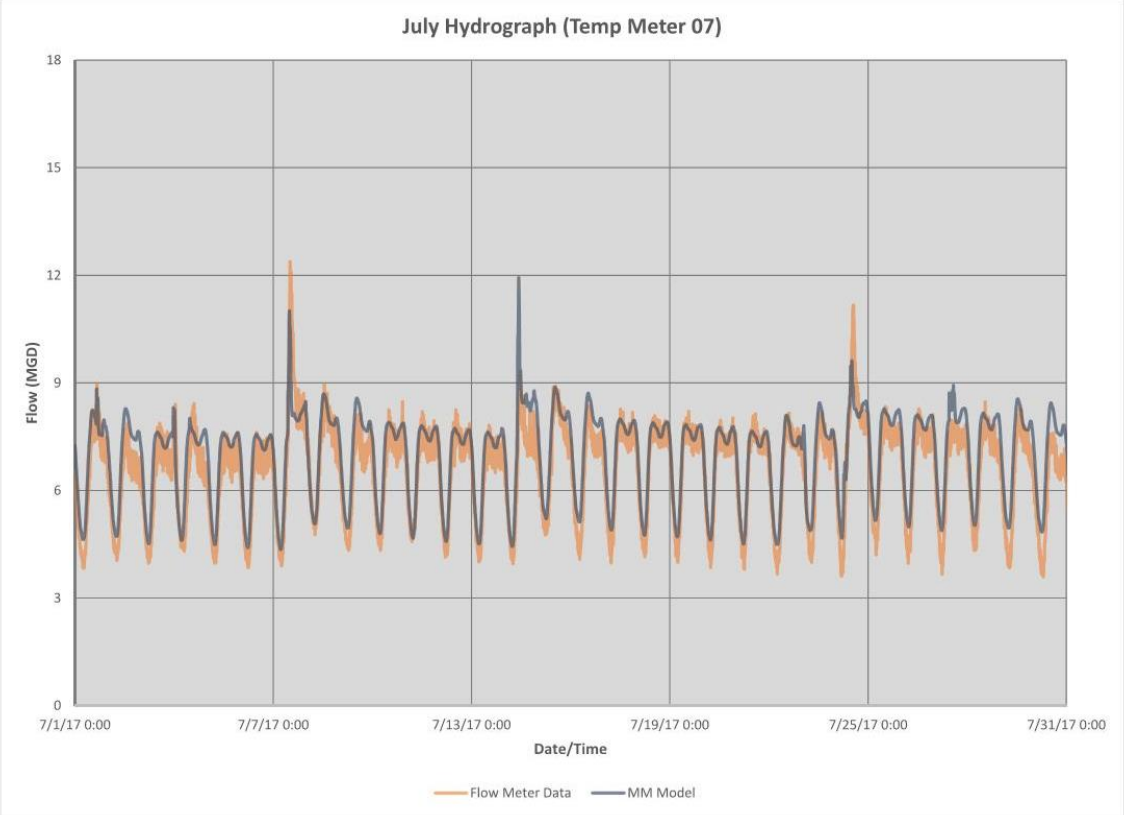
Storm Date	Type	Temp Meter 07 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	12.99	12.03	-8.0%	37.10	37.57	1.2%	23.2	20.0	-3.1
04/20/17	Calibration	9.27	8.02	-15.6%	6.00	5.26	-13.9%	18.9	16.7	-2.2
04/21/17	Validation	9.61	9.09	-5.6%	9.39	9.11	-3.0%	19.3	17.7	-1.6
05/13/17	Validation	13.33	13.04	-2.2%	51.77	49.34	-4.9%	23.6	20.8	-2.8
05/25/17	Calibration	10.03	9.38	-6.9%	24.97	24.30	-2.8%	19.7	17.9	-1.8
05/31/17	Calibration	9.22	8.72	-5.7%	2.31	2.06	-12.4%	18.8	17.3	-1.5
06/16/17	Calibration	8.84	7.56	-16.9%	3.28	3.15	-4.3%	18.5	16.3	-2.3
06/17/17	Validation	8.47	7.58	-11.6%	6.43	6.05	-6.3%	18.2	13.9	-4.3
06/23/17	Calibration	9.51	9.40	-1.1%	15.32	17.16	10.7%	19.1	17.9	-1.1
07/07/17	Calibration	12.38	11.01	-12.4%	13.96	14.11	1.1%	22.0	19.2	-2.8
07/22/17	Validation	8.17	8.45	3.3%	5.18	5.60	7.5%	17.8	17.1	-0.7
07/24/17	Calibration	11.18	9.62	-16.2%	15.30	16.11	5.0%	21.0	18.1	-2.9
08/07/17	Calibration	9.10	8.01	-13.5%	12.05	12.40	2.8%	18.7	16.7	-2.0
08/15/17	Calibration	8.01	7.94	-0.8%	6.87	7.67	10.5%	17.4	16.6	-0.8
08/18/17	Validation	10.23	10.88	6.0%	13.14	14.22	7.6%	20.0	19.1	-0.8
Averages		10.0	9.4	-6.8%	14.9	14.9	0.5%	19.7	17.7	-2.0

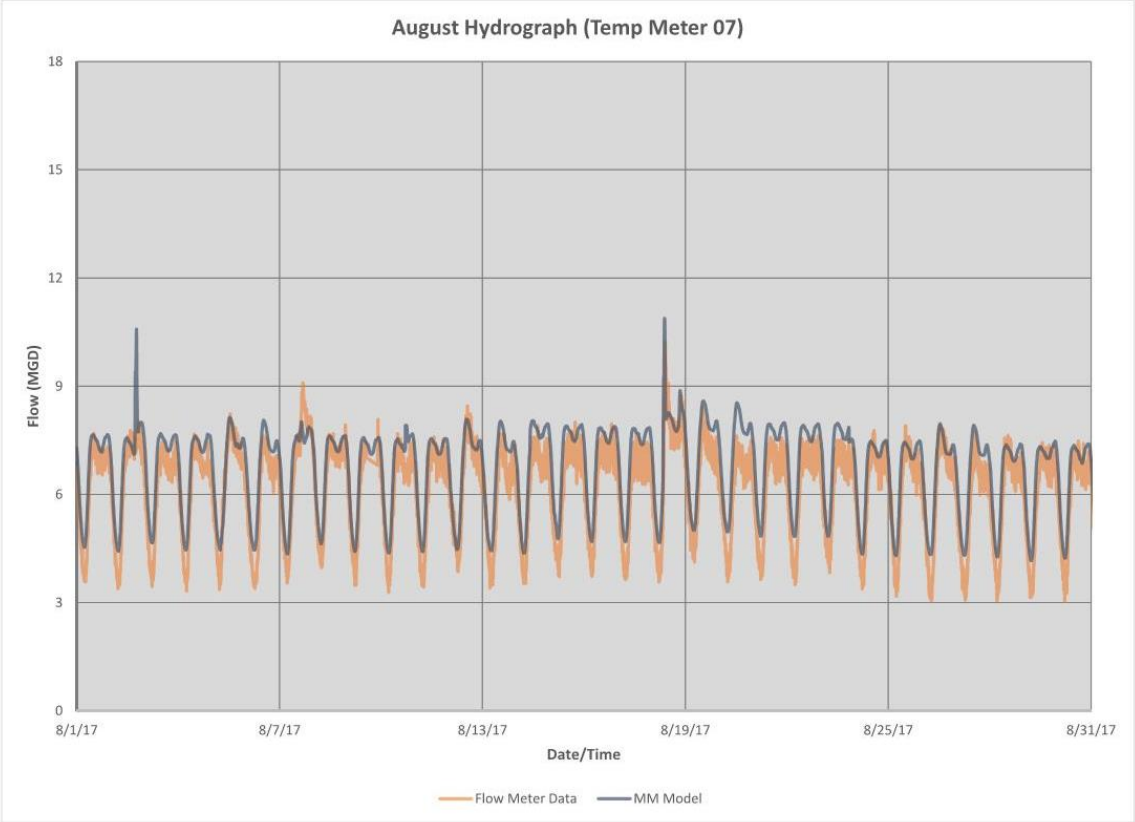


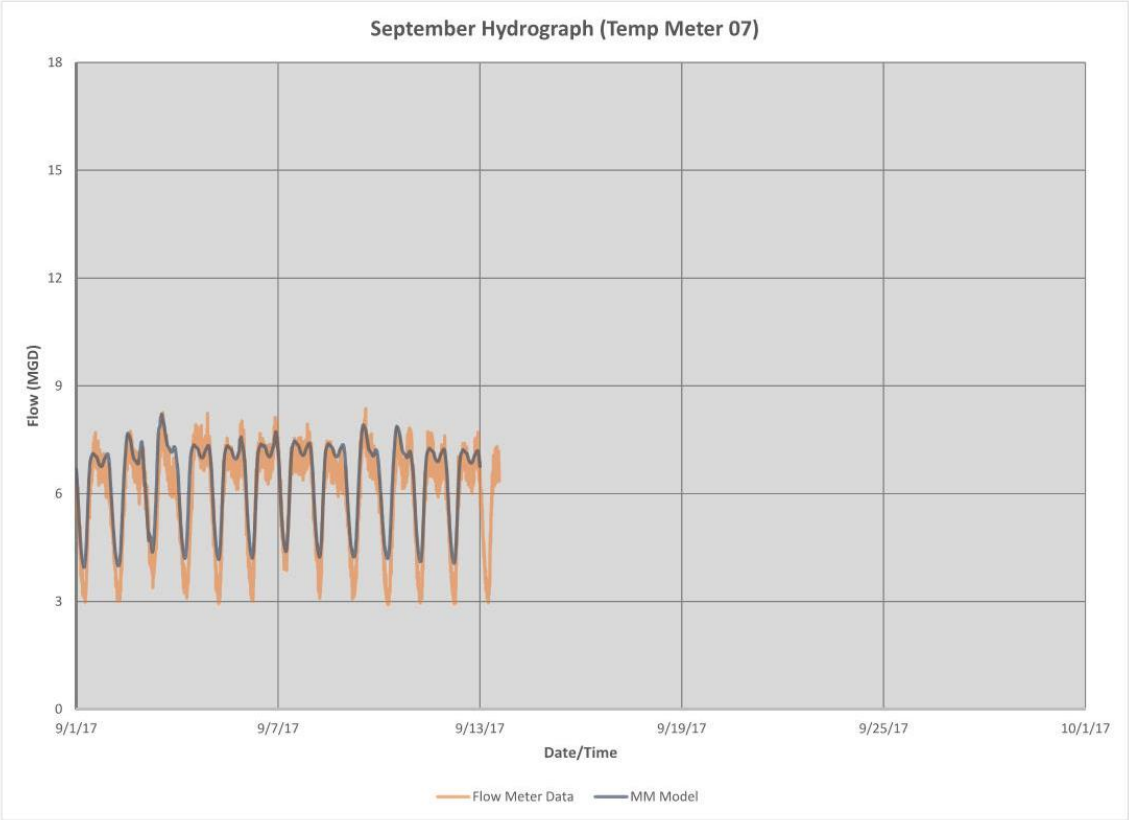

April Hydrograph (Temp Meter 07)
Flow (MGD)
18
15
12
9
6
3
0
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

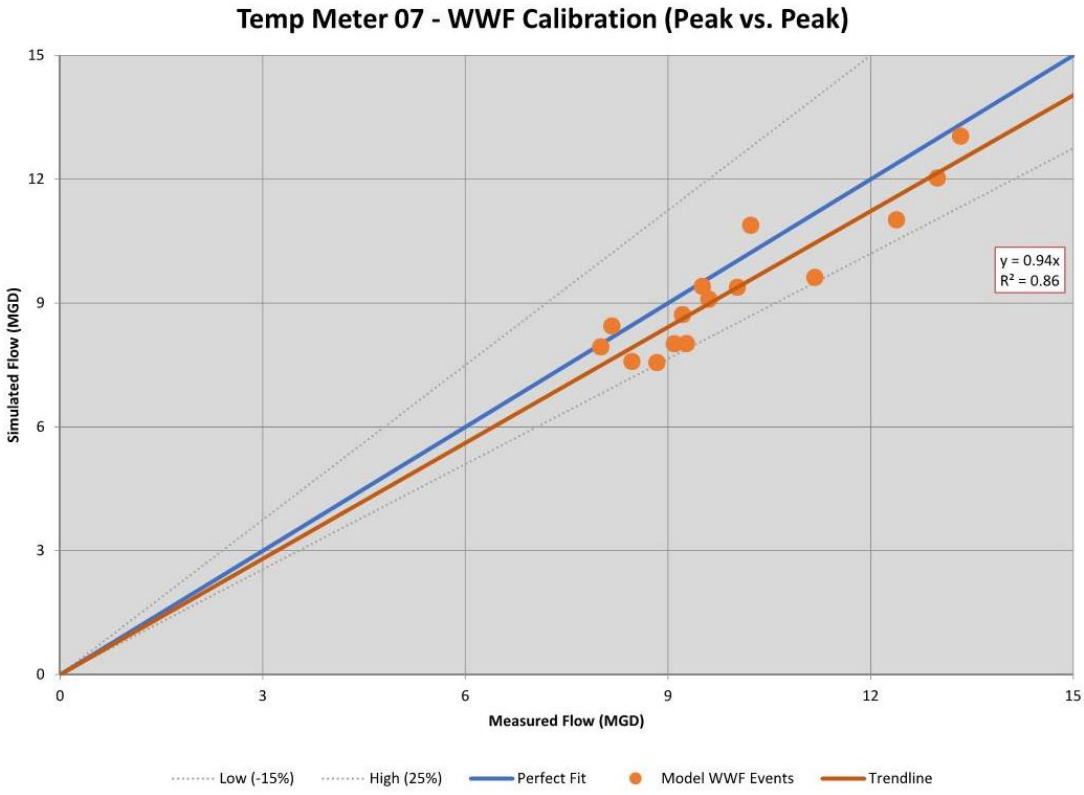

May Hydrograph (Temp Meter 07)
Flow (MGD)
25
20
15
10
5
0
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 07)
Flow (MGD)
18
15
12
9
6
3
0
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 07)
Flow (MGD)
18
15
12
9
6
3
0
7/1/17 0:00
7/7/17 0:00
7/13/17 0:00
7/19/17 0:00
7/25/17 0:00
7/31/17 0:00
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meter 07)
Flow (MGD)
18
15
12
9
6
3
0
8/1/17
8/7/17
8/13/17
8/19/17
8/25/17
8/31/17
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meter 07)
Flow (MGD)
18
15
12
9
6
3
0
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meter 07 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.94x
R² = 0.86
0
3
6
9
12
15
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

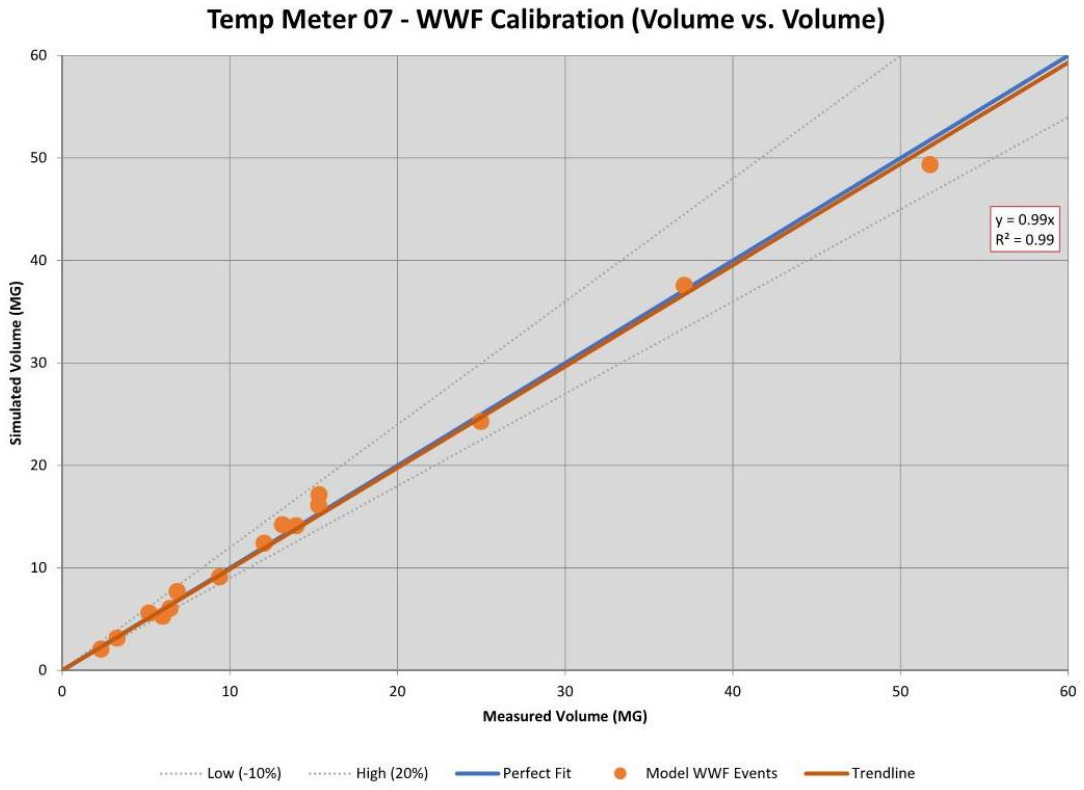
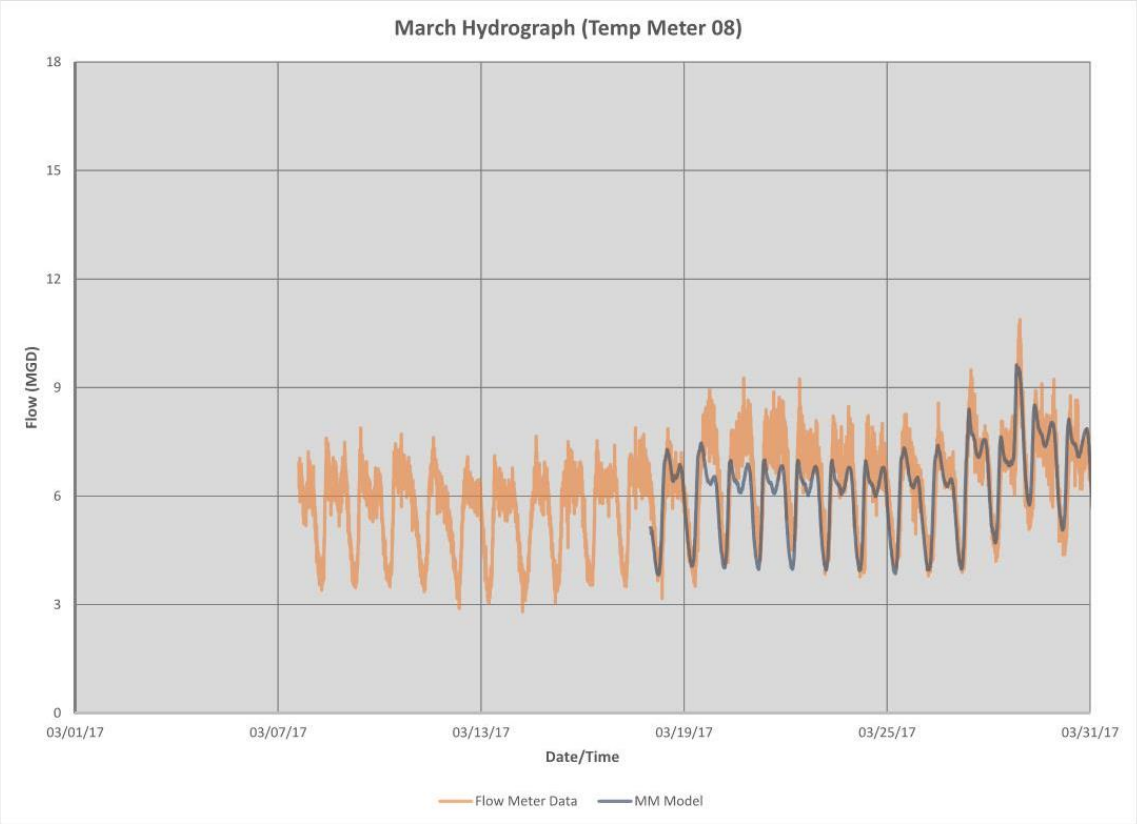
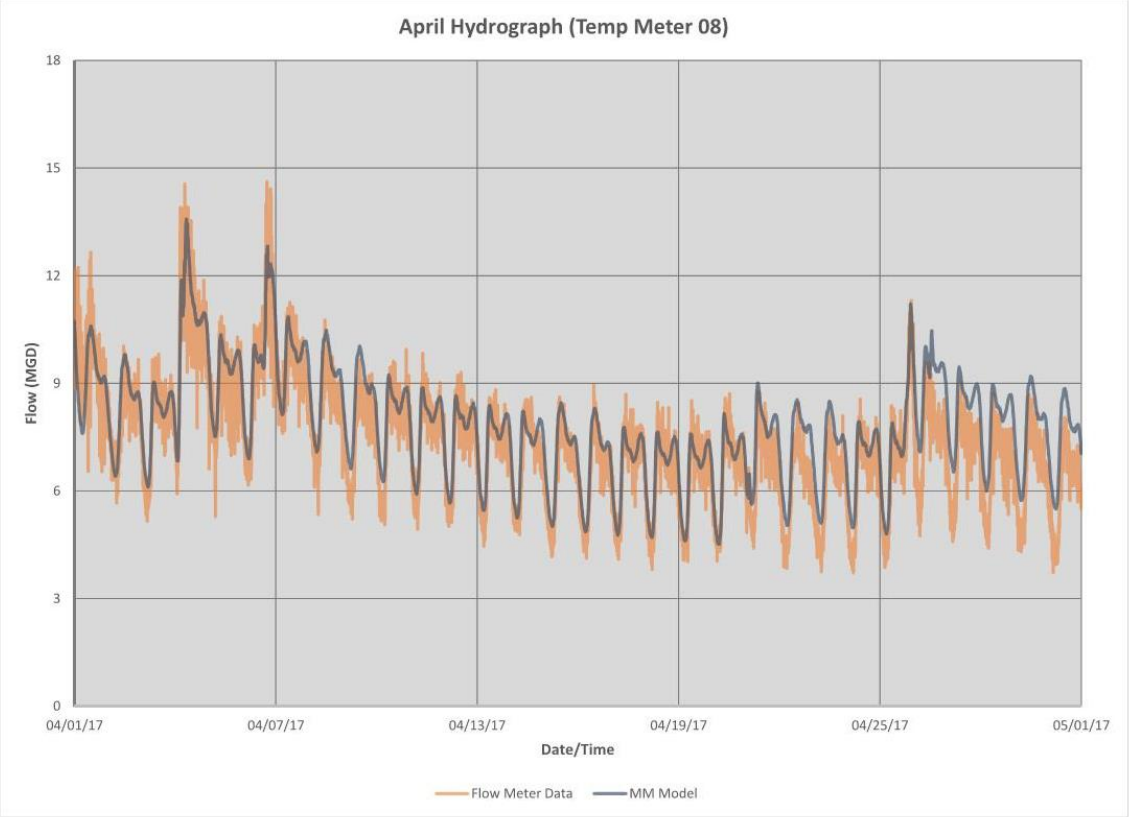
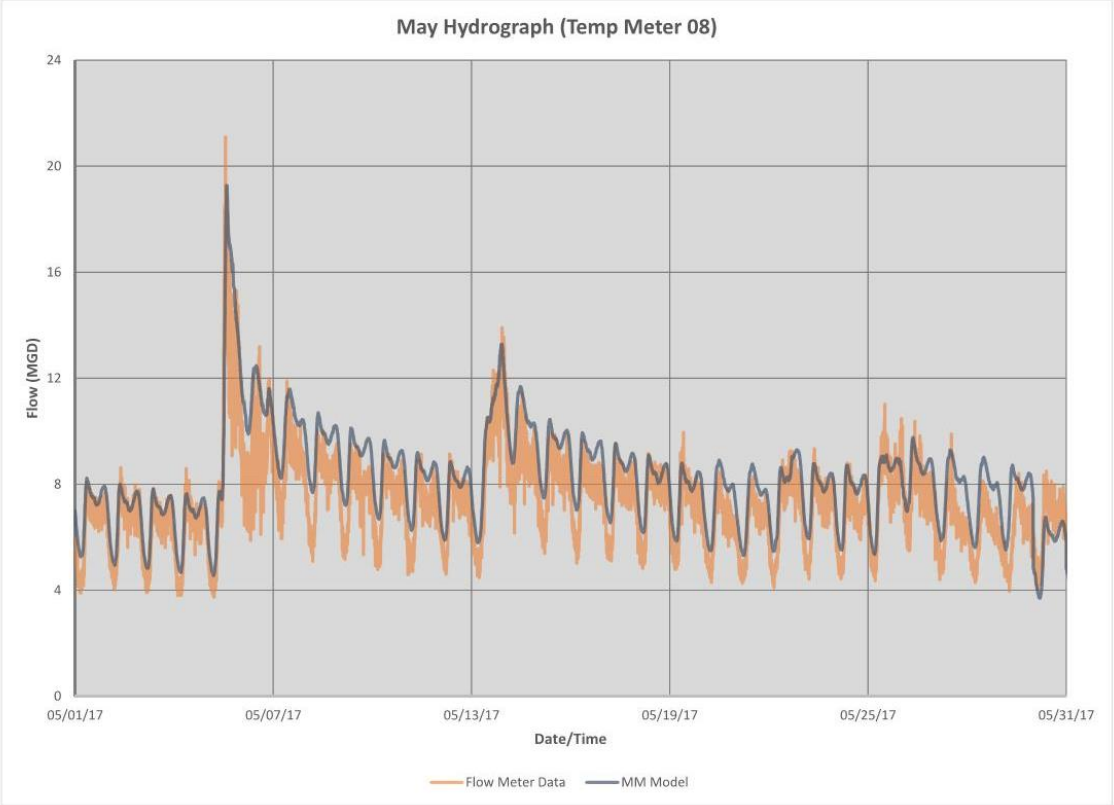

Temp Meter 07 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 0.99x
R² = 0.99
0
10
20
30
40
50
60
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

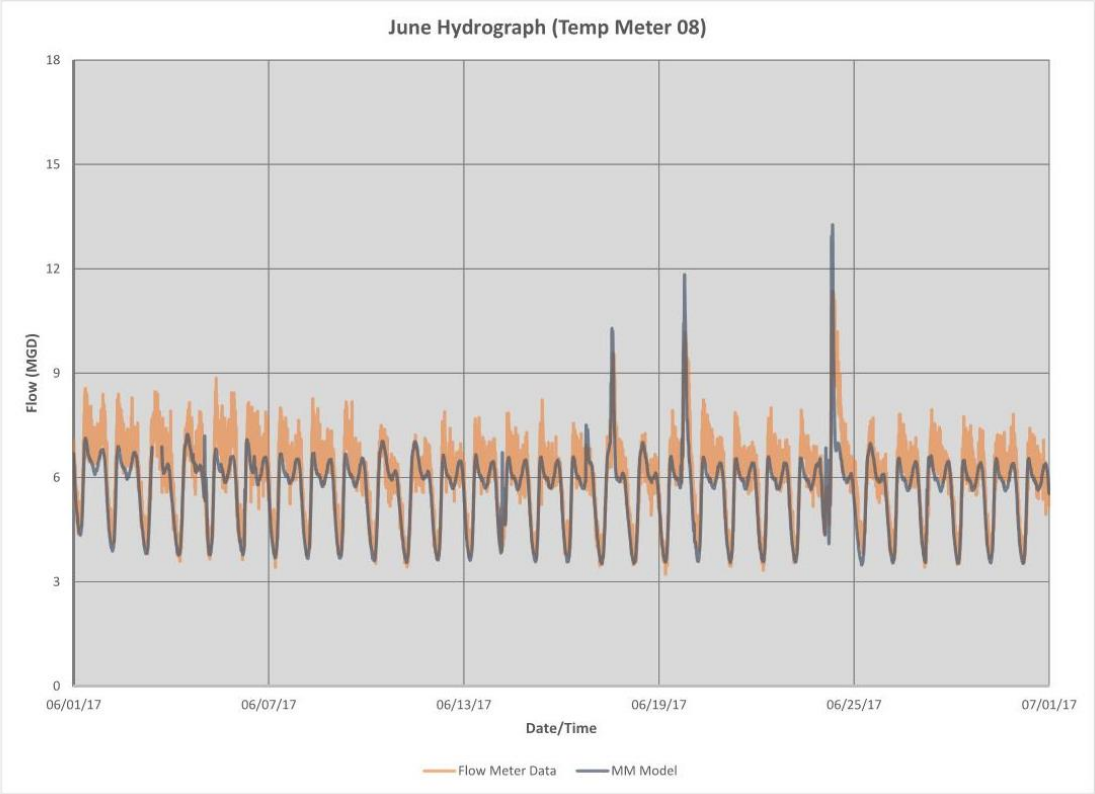
Table 8-15 Temp Meter 08 WW Flow Statistics

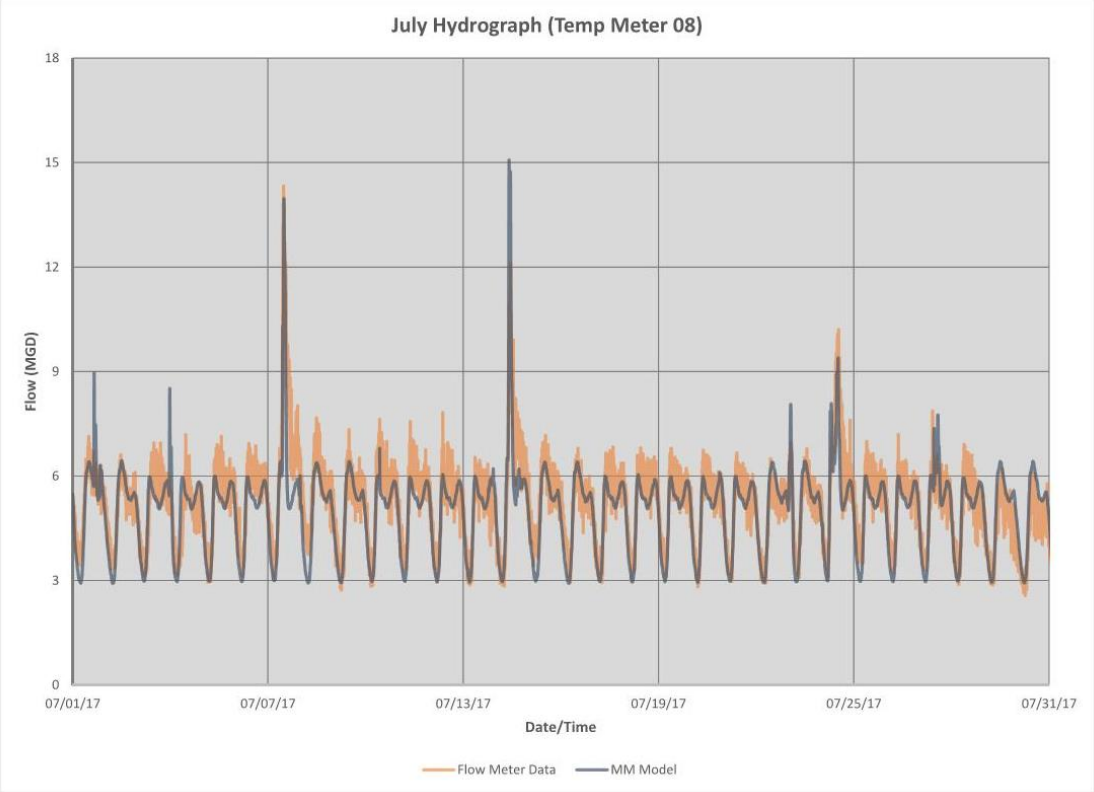
Storm Date	Type	Temp Meter 08 Wet Weather Flow Statistics								
		Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	15.39	12.12	-27.0%	33.12	33.15	0.1%	37.1	21.1	-16.1
04/20/17	Calibration	8.71	8.16	-6.8%	5.01	5.17	3.0%	27.4	17.1	-10.3
04/21/17	Validation	8.78	9.01	2.6%	7.60	8.61	11.7%	27.9	18.0	-10.0
05/13/17	Validation	13.92	13.29	-4.7%	42.26	47.97	11.9%	34.0	22.4	-11.6
05/25/17	Calibration	11.03	9.77	-12.9%	21.88	24.31	10.0%	30.4	18.9	-11.5
05/31/17	Calibration	8.64	7.80	-10.8%	1.90	1.80	-5.8%	27.9	16.8	-11.1
06/16/17	Calibration	6.94	7.51	7.6%	2.60	2.67	2.9%	25.0	16.5	-8.5
06/17/17	Validation	7.40	6.44	-14.9%	5.44	5.02	-8.5%	25.8	12.3	-13.5
06/23/17	Calibration	11.37	13.27	14.3%	14.25	13.37	-6.5%	32.5	22.3	-10.2
07/07/17	Calibration	14.34	13.97	-2.6%	11.83	10.19	-16.1%	36.8	23.0	-13.8
07/22/17	Validation	6.98	8.06	13.5%	4.20	4.25	1.4%	25.9	17.0	-8.8
07/24/17	Calibration	10.21	9.40	-8.7%	12.45	11.25	-10.7%	31.1	18.4	-12.7
08/07/17	Calibration	8.25	6.84	-20.7%	8.51	8.91	4.5%	29.9	15.7	-14.2
08/15/17	Calibration	6.34	5.86	-8.3%	4.99	5.24	4.8%	25.0	14.4	-10.6
08/18/17	Validation	9.95	13.18	24.5%	7.42	9.77	24.0%	37.0	22.2	-14.8
Averages		9.9	9.6	-2.5%	13.6	14.2	4.1%	30.1	18.7	-11.4

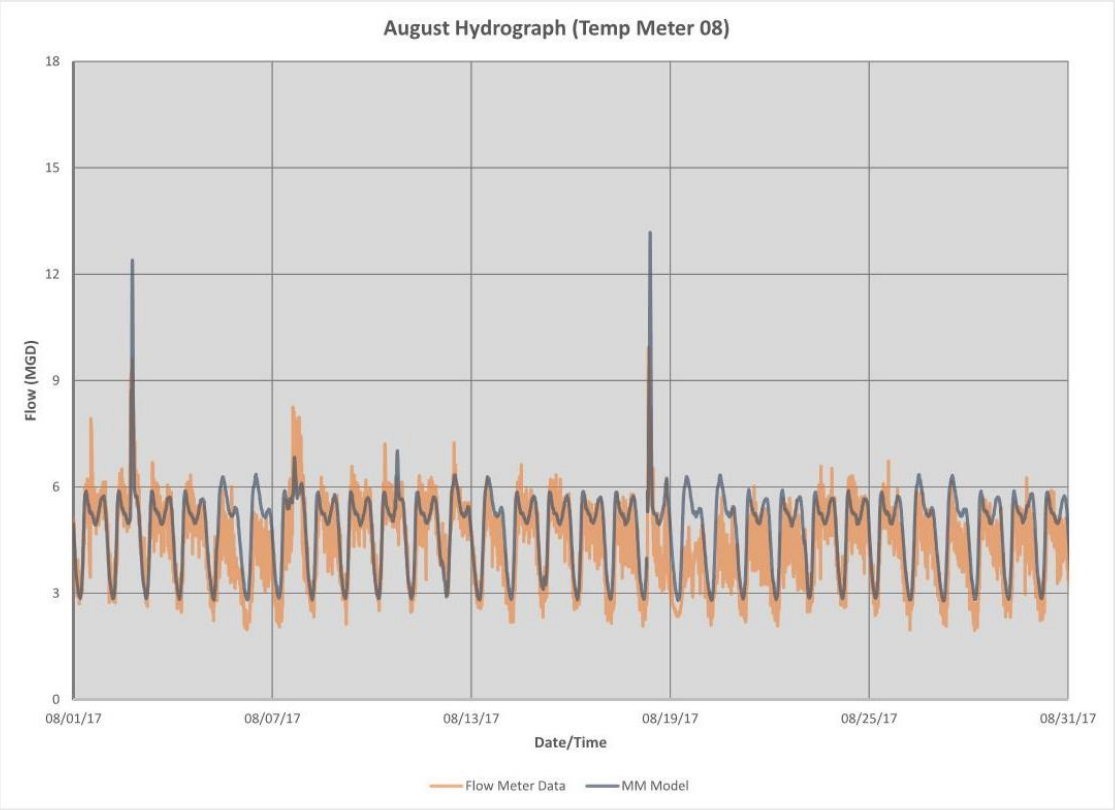


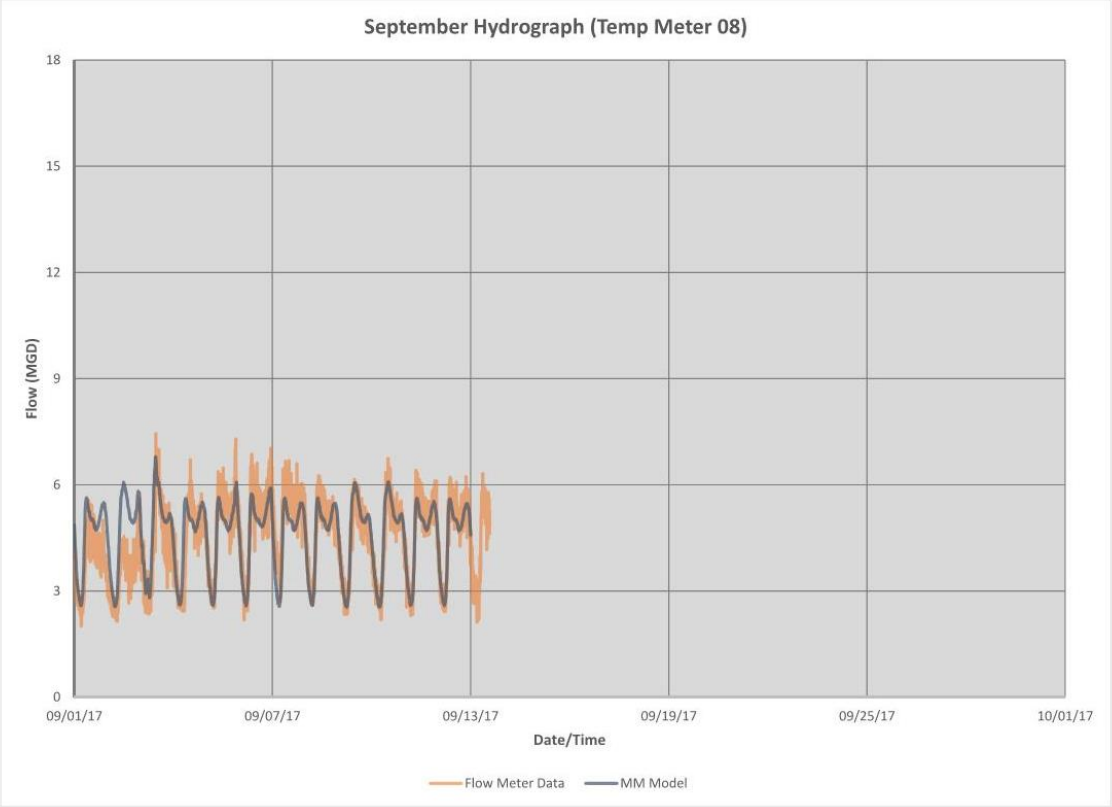

April Hydrograph (Temp Meter 08)
Flow (MGD)
18
15
12
9
6
3
0
04/01/17
04/07/17
04/13/17
04/19/17
04/25/17
05/01/17
Date/Time
Flow Meter Data
MM Model

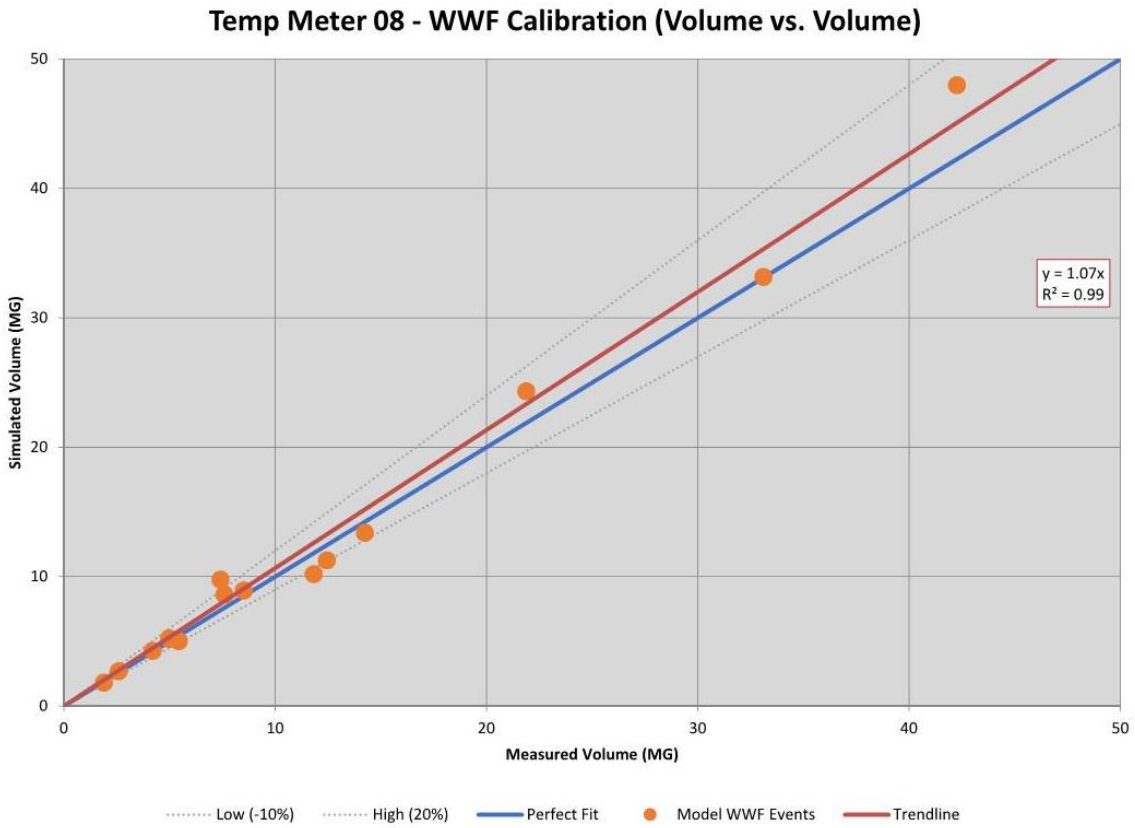

May Hydrograph (Temp Meter 08)
Flow (MGD)
24
20
16
12
8
4
0
05/01/17
05/07/17
05/13/17
05/19/17
05/25/17
05/31/17
Date/Time
Flow Meter Data
MM Model


June Hydrograph (Temp Meter 08)
Flow (MGD)
0
3
6
9
12
15
18
06/01/17
06/07/17
06/13/17
06/19/17
06/25/17
07/01/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meter 08)
Flow (MGD)
0
3
6
9
12
15
18
07/01/17
07/07/17
07/13/17
07/19/17
07/25/17
07/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meter 08)
Flow (MGD)
18
15
12
9
6
3
0
08/01/17
08/07/17
08/13/17
08/19/17
08/25/17
08/31/17
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meter 08)
Flow (MGD)
18
15
12
9
6
3
0
09/01/17
09/07/17
09/13/17
09/19/17
09/25/17
10/01/17
Date/Time
Flow Meter Data
MM Model


Temp Meter 08 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 1.07x
R² = 0.99
0
10
20
30
40
50
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

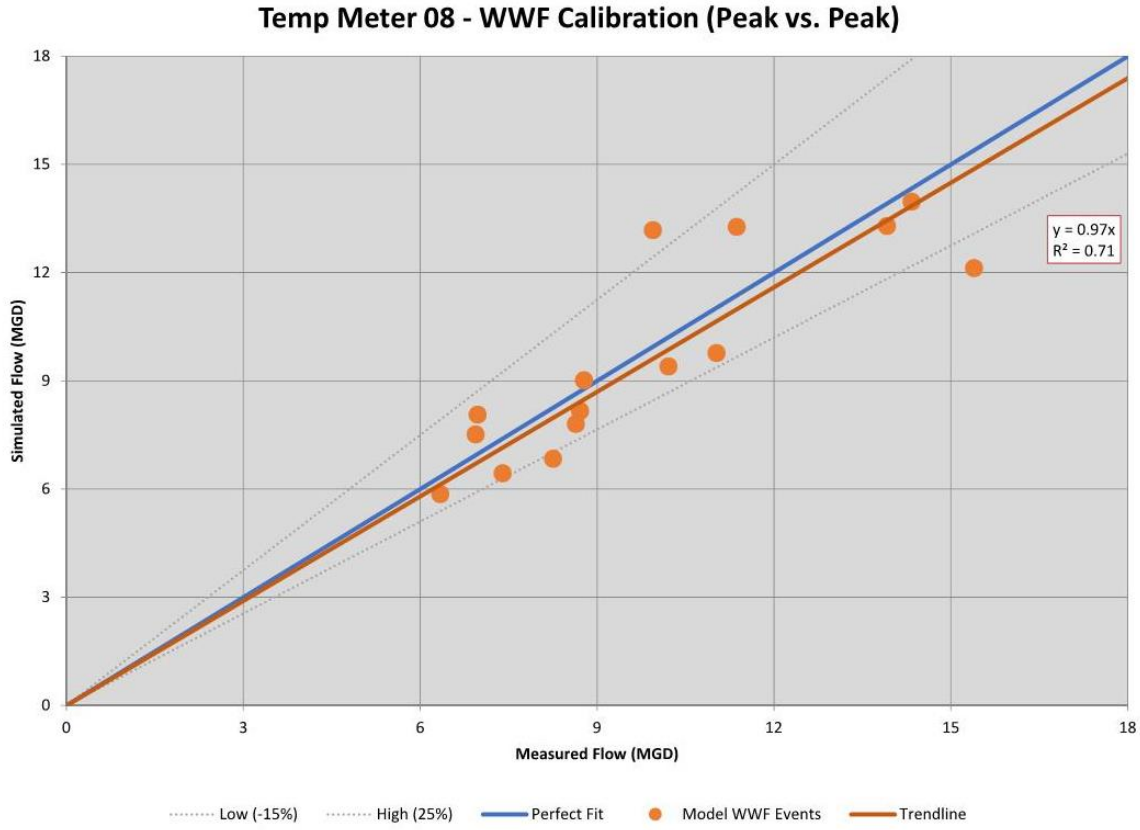
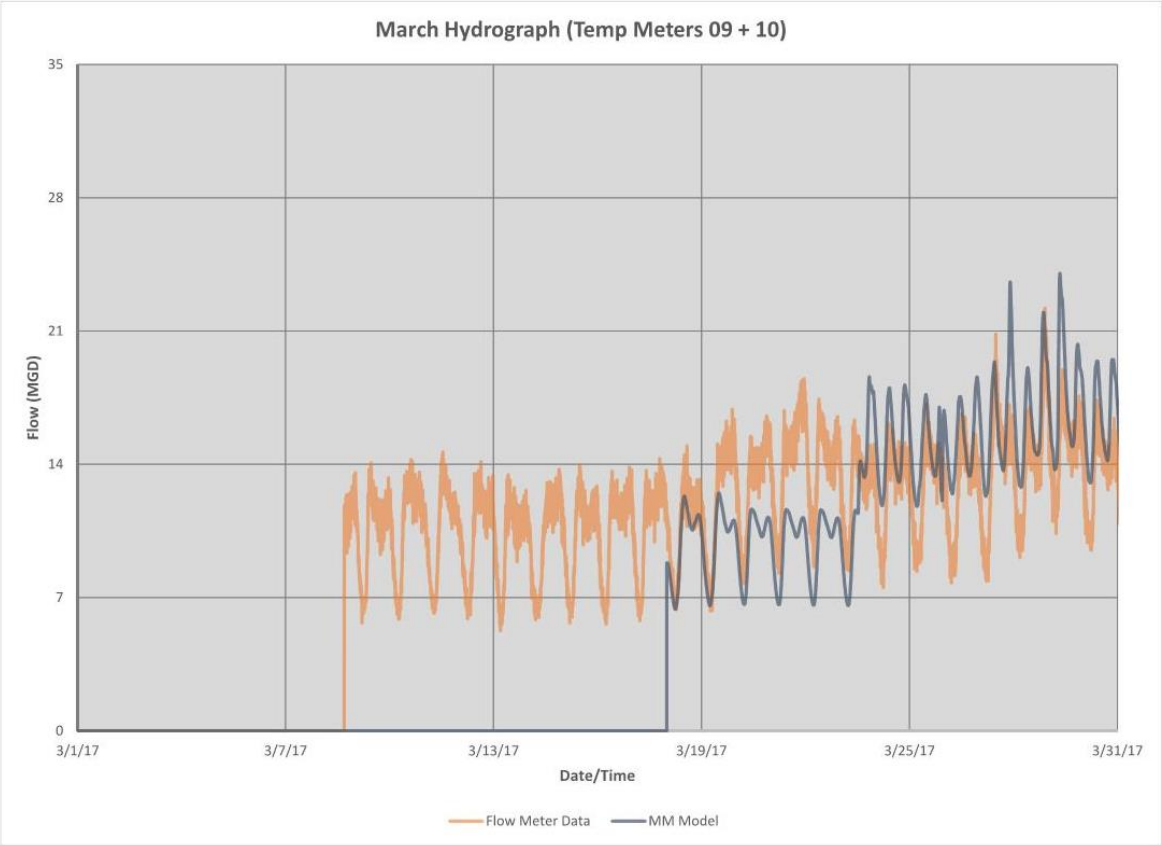
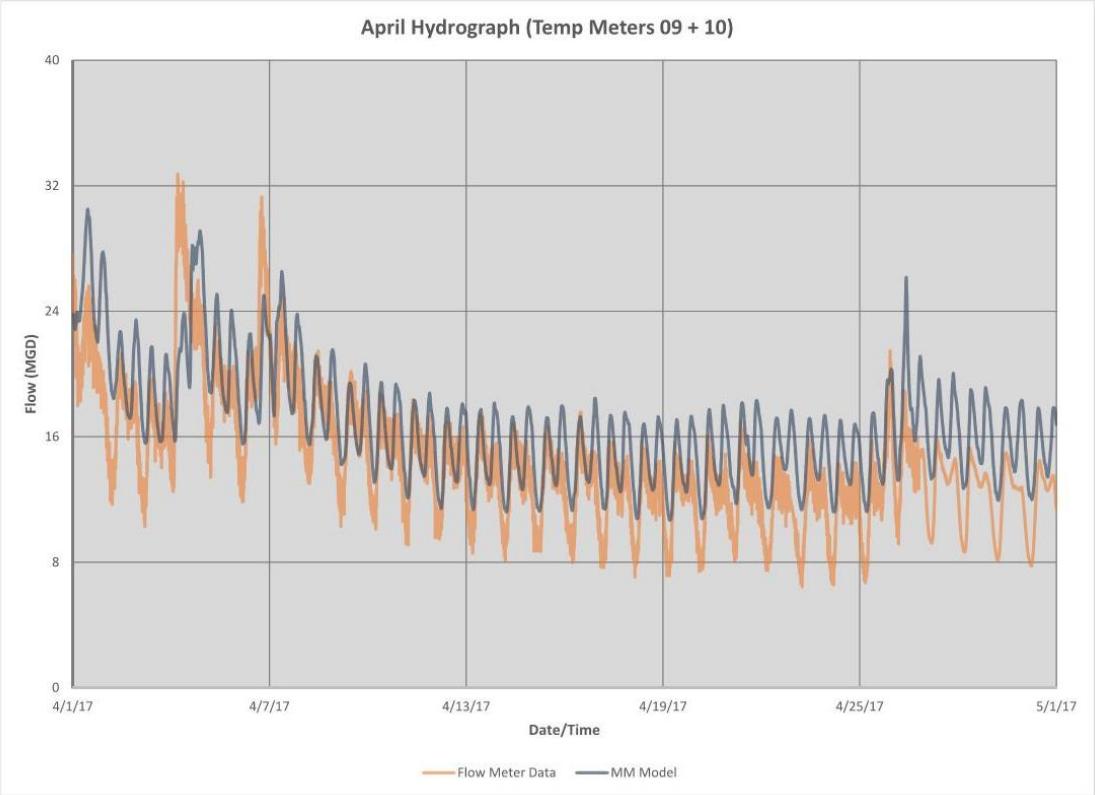
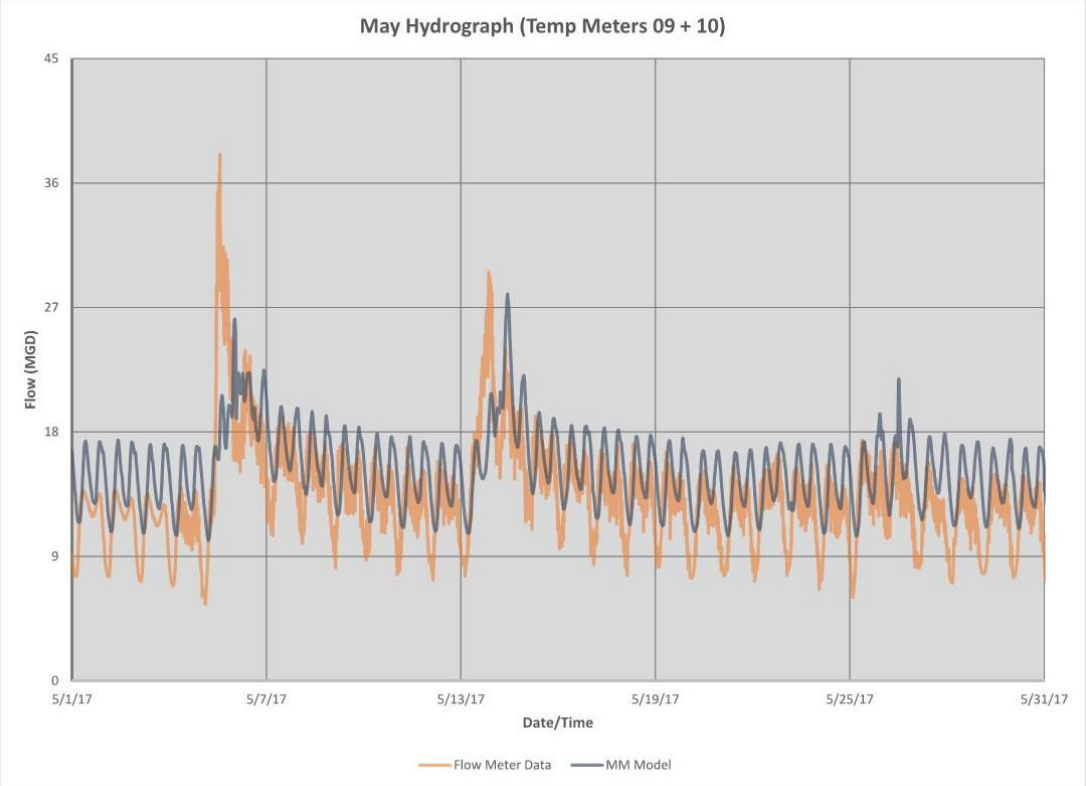

Temp Meter 08 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 0.97x
R² = 0.71
0
3
6
9
12
15
18
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline

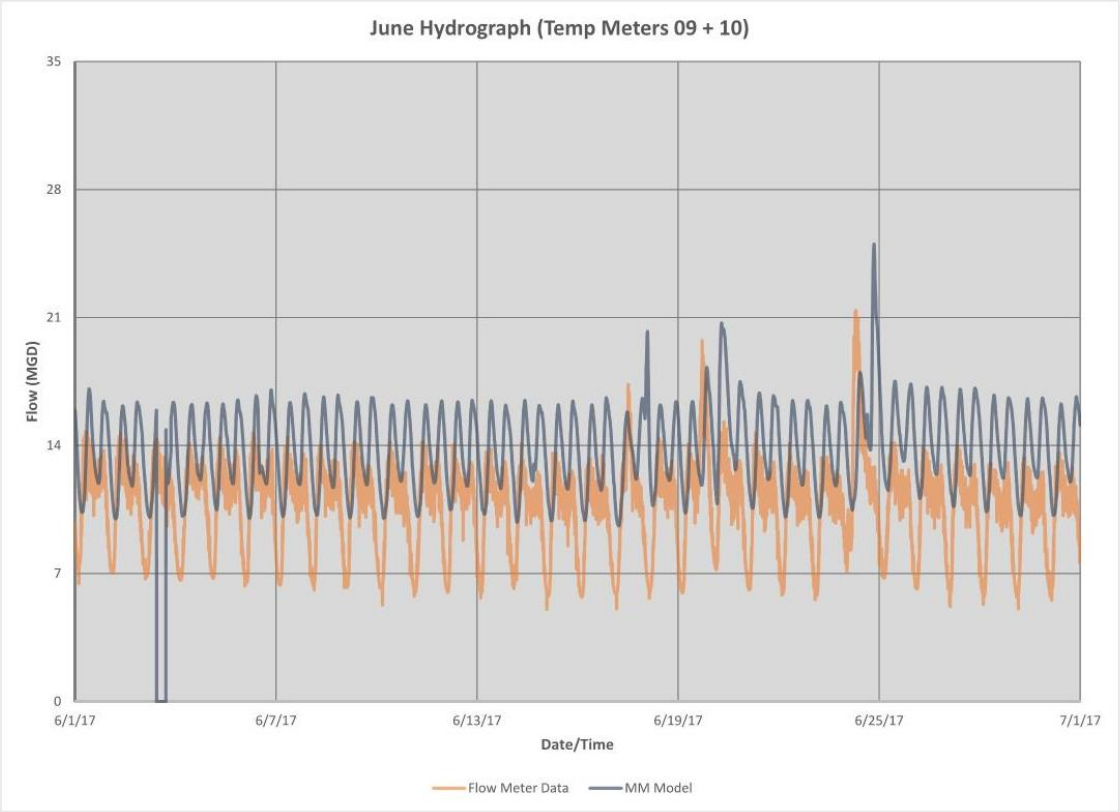
Table 8-16 Temp Meter 09 & 10 WW Flow Statistics

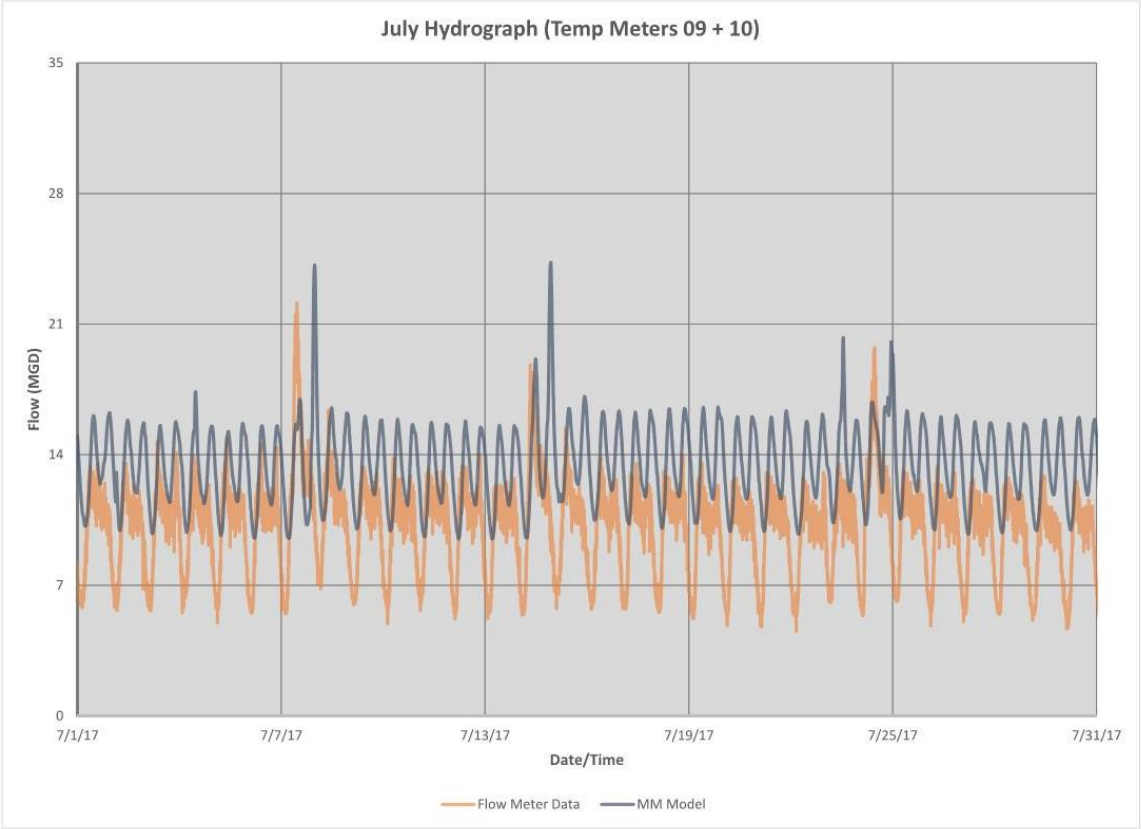
Temp Meters 09 + 10 Wet Weather Flow Statistics										
Storm Date	Type	Peak Flow (MGD)			Storm Volume (MG)			Peak Depth (Inches)		
		Measured	Simulated	% Diff.	Measured	Simulated	% Diff.	Measured	Simulated	Diff.
03/31/17	Calibration	32.49	30.51	-6.5%	71.05	80.32	11.5%	0.0	0.0	0.0
04/20/17	Calibration	16.09	18.01	10.7%	9.33	10.83	13.8%	0.0	0.0	0.0
04/21/17	Validation	16.98	18.32	7.4%	14.18	17.80	20.3%	0.0	0.0	0.0
05/13/17	Validation	29.56	27.98	-5.6%	81.08	86.24	6.0%	0.0	0.0	0.0
05/25/17	Calibration	17.43	21.84	20.2%	38.49	45.93	16.2%	0.0	0.0	0.0
05/31/17	Calibration	15.95	16.96	5.9%	2.90	4.30	32.4%	0.0	0.0	0.0
06/16/17	Calibration	13.49	16.62	18.9%	4.20	6.45	34.8%	0.0	0.0	0.0
06/17/17	Validation	13.23	16.62	20.4%	9.86	11.19	11.8%	0.0	0.0	0.0
06/23/17	Calibration	21.40	25.03	14.5%	26.04	34.49	24.5%	0.0	0.0	0.0
07/07/17	Calibration	22.14	24.17	8.4%	22.01	26.54	17.1%	0.0	0.0	0.0
07/22/17	Validation	13.52	20.28	33.3%	8.29	11.18	25.9%	0.0	0.0	0.0
07/24/17	Calibration	19.75	20.06	1.6%	23.39	31.00	24.6%	0.0	0.0	0.0
08/07/17	Calibration	17.73	17.75	0.1%	20.10	25.19	20.2%	0.0	0.0	0.0
08/15/17	Calibration	14.00	15.07	7.1%	10.61	13.86	23.5%	0.0	0.0	0.0
08/18/17	Validation	26.03	22.65	-14.9%	22.44	26.25	14.5%	0.0	0.0	0.0
Averages		19.3	20.8	7.1%	26.1	30.5	14.3%			

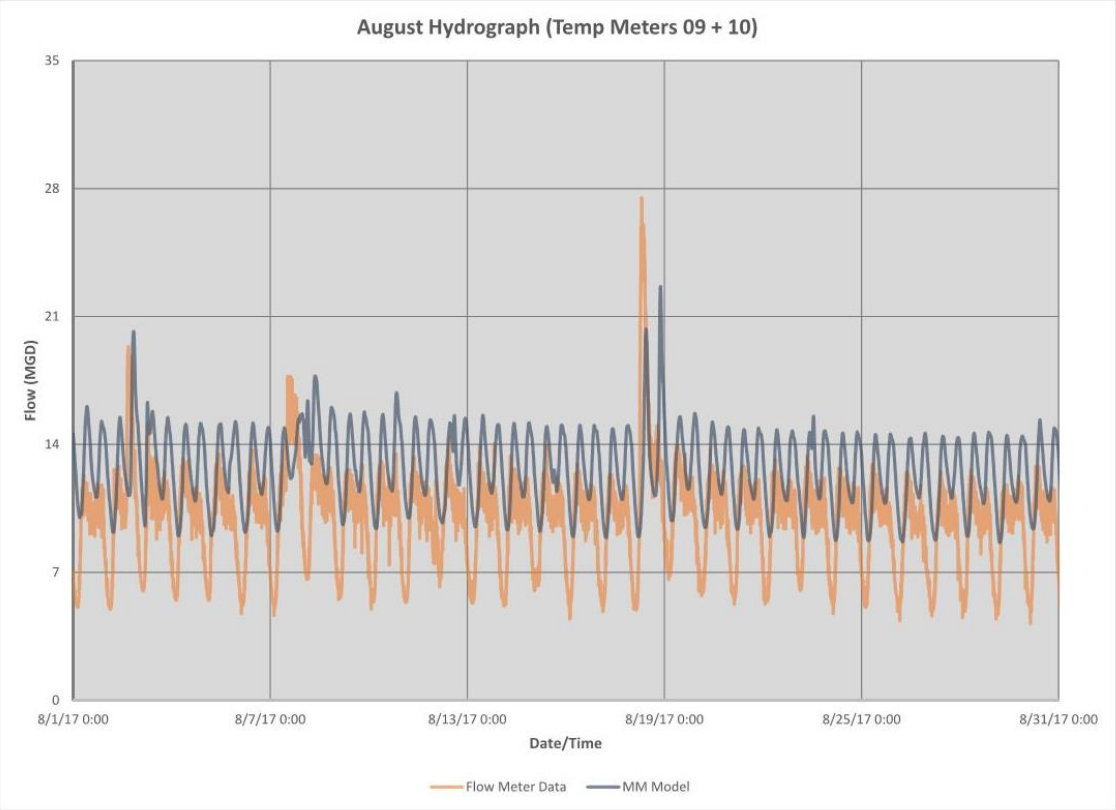


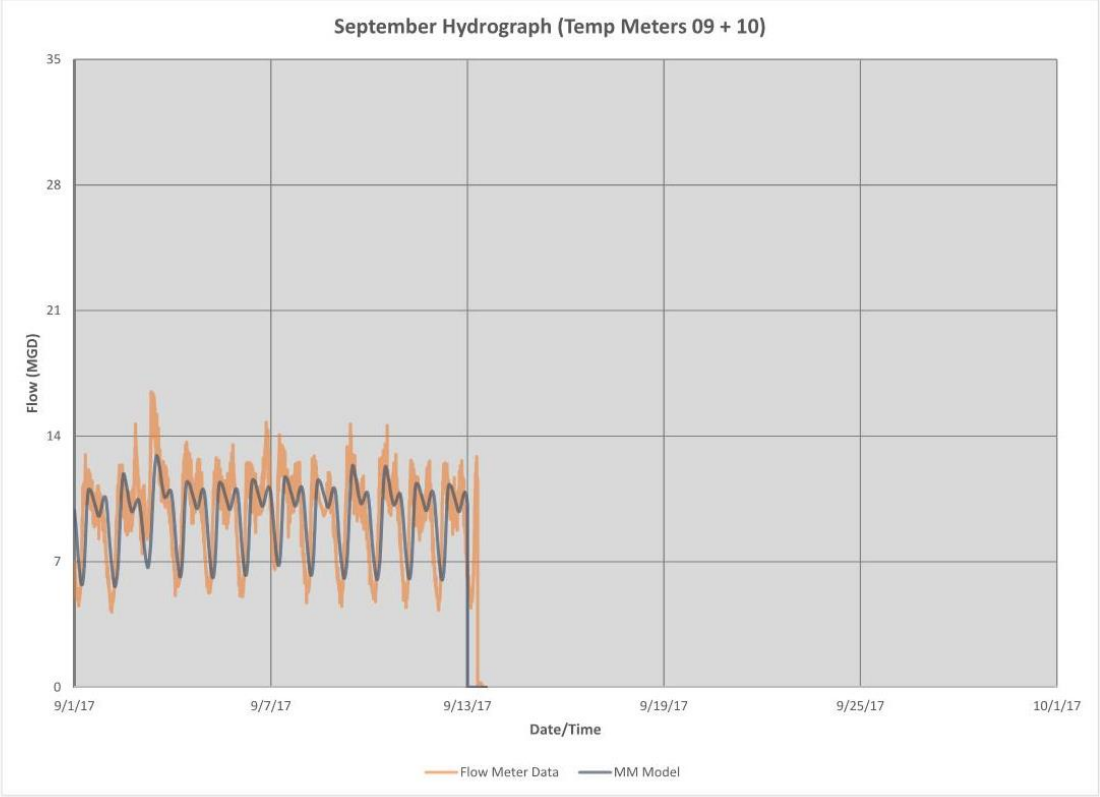

April Hydrograph (Temp Meters 09 + 10)
40
32
24
16
8
0
Flow (MGD)
4/1/17
4/7/17
4/13/17
4/19/17
4/25/17
5/1/17
Date/Time
Flow Meter Data
MM Model

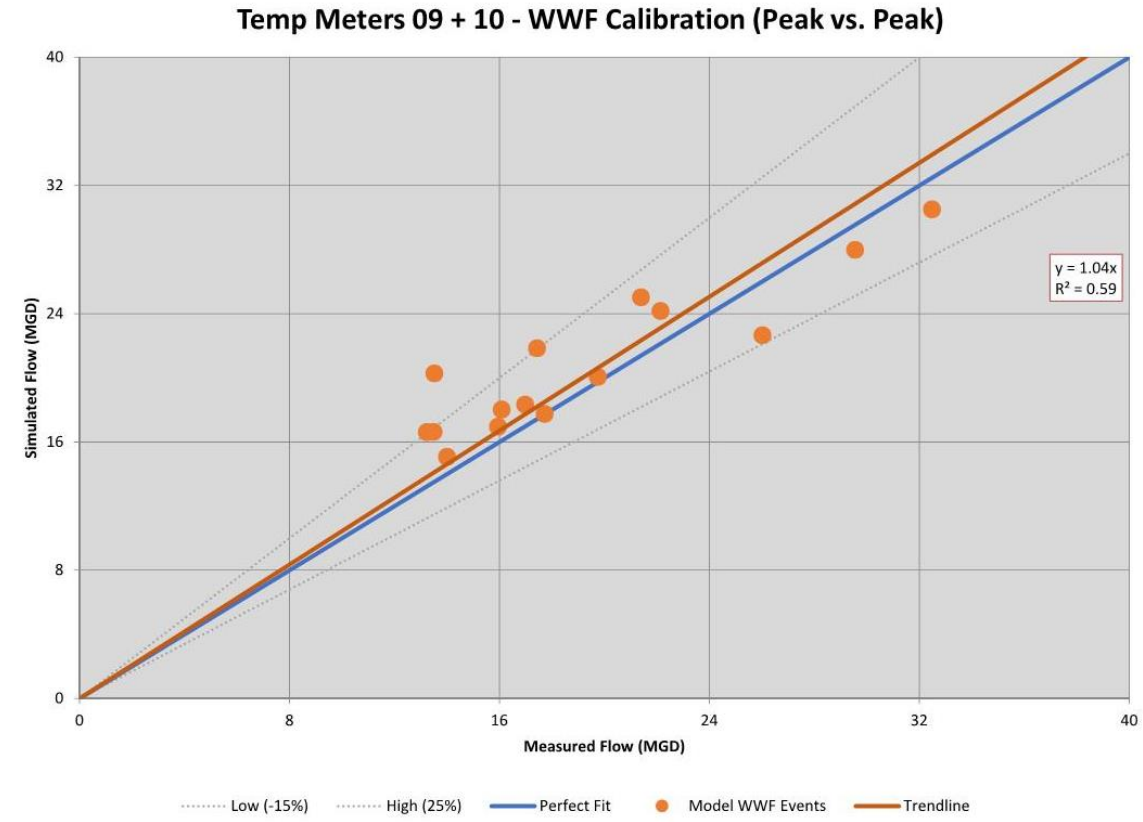

May Hydrograph (Temp Meters 09 + 10)
45
36
27
18
9
0
Flow (MGD)
5/1/17
5/7/17
5/13/17
5/19/17
5/25/17
5/31/17
Date/Time
Flow Meter Data
MM Model

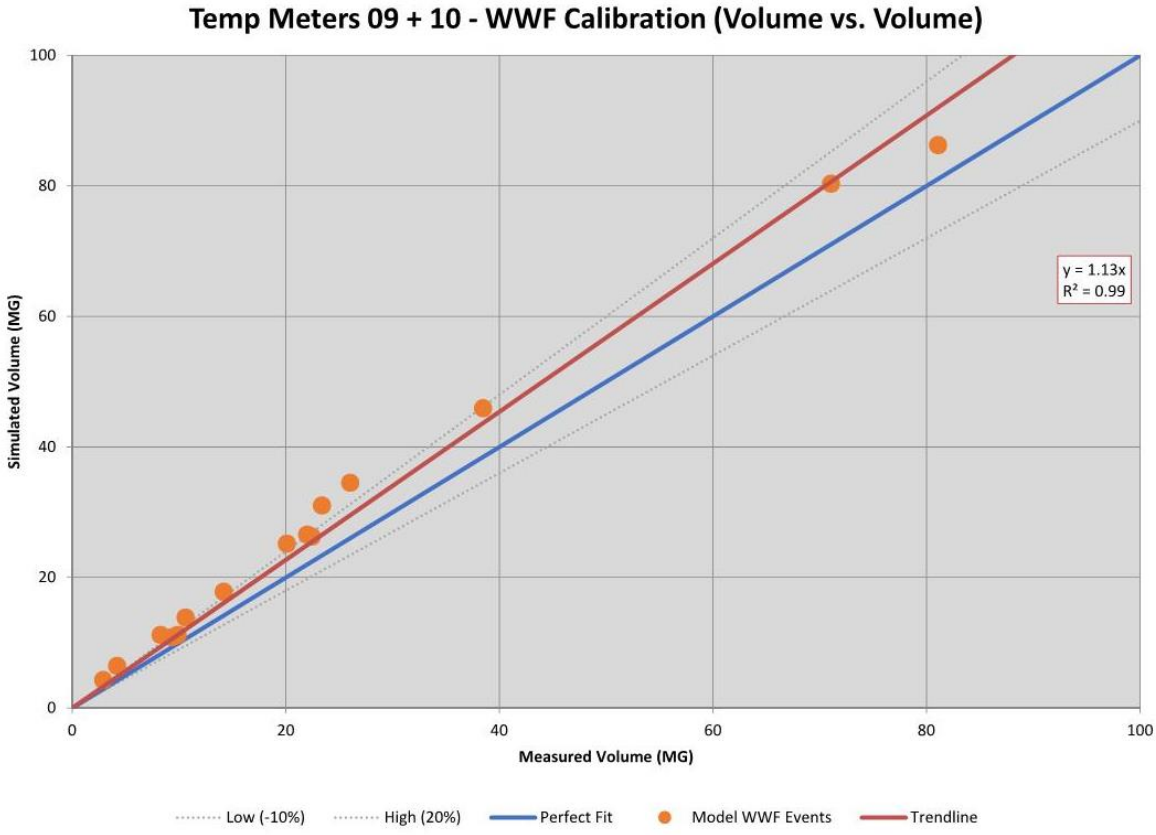

June Hydrograph (Temp Meters 09 + 10)
35
28
21
14
7
0
Flow (MGD)
6/1/17
6/7/17
6/13/17
6/19/17
6/25/17
7/1/17
Date/Time
Flow Meter Data
MM Model


July Hydrograph (Temp Meters 09 + 10)
35
28
21
14
7
0
Flow (MGD)
7/1/17
7/7/17
7/13/17
7/19/17
7/25/17
7/31/17
Date/Time
Flow Meter Data
MM Model


August Hydrograph (Temp Meters 09 + 10)
35
28
21
14
7
0
Flow (MGD)
8/1/17 0:00
8/7/17 0:00
8/13/17 0:00
8/19/17 0:00
8/25/17 0:00
8/31/17 0:00
Date/Time
Flow Meter Data
MM Model


September Hydrograph (Temp Meters 09 + 10)
35
28
21
14
7
0
Flow (MGD)
9/1/17
9/7/17
9/13/17
9/19/17
9/25/17
10/1/17
Date/Time
Flow Meter Data
MM Model


Temp Meters 09 + 10 - WWF Calibration (Peak vs. Peak)
Simulated Flow (MGD)
Measured Flow (MGD)
y = 1.04x
R² = 0.59
0
8
16
24
32
40
Low (-15%)
High (25%)
Perfect Fit
Model WWF Events
Trendline


Temp Meters 09 + 10 - WWF Calibration (Volume vs. Volume)
Simulated Volume (MG)
Measured Volume (MG)
y = 1.13x
R² = 0.99
0
20
40
60
80
100
Low (-10%)
High (20%)
Perfect Fit
Model WWF Events
Trendline

8.4 Water Quality Calibration Results

Please reference the individual Sewer System Characterization Reports from the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park for this data.

8.5 Extended Period CSO Simulation for Calendar Year 2004

Please reference the individual Sewer System Characterization Reports from the Borough of Fort Lee, the City of Hackensack, and the Village of Ridgefield Park for this data.

9 Temporary Monitoring Stations and Data

The System Characterization Monitoring Program as proposed in the BCUA Monitoring and Modeling Quality Assurance Program Plan (QAPP), and subsequently approved by the NJDEP consisted of a minimum four (4) month flow and rainfall monitoring effort. The study design was based on a combination of knowledge of the BCUA Trunk Sewer Systems and professional judgment. The study was designed to provide an accurate characterization of the existing dry and wet weather flows into the BCUA Trunk Sewer, including RDII flows from separately sewered areas. The monitoring sites were selected to capture hydraulically important locations that would provide significant insight into the hydraulic performance of the BCUA's trunk system.

There are four main trunk sewers transporting flow to the BCUA WCPF: the Overpeck Valley Trunk Sewer; the Overpeck Valley Relief Sewer; the BCUA Main Trunk Sewer (District Sewer System Stage 2); and the Southern Trunk servicing the municipalities of Lyndhurst, Rutherford, East Rutherford, Carlstadt, Moonachie, Woodridge, and Hasbrouck Heights. The Overpeck Trunk and Relief Sewers located east of the WPCF have six junction chambers where flows from the two sewers intersect and comingle. Accordingly, hydraulic grades and flows within these two sewers were monitored at the last junction chamber to verify model hydraulics. The exact manholes to be used for monitoring were established following a field check to verify that the metering sites are accessible and that the hydraulics are favorable for collecting high quality flow monitoring data. Several proposed metering locations had to be moved due to hydraulics or lack of access. The final monitoring and modeling manholes used were illustrated in Figure 11 in Section 4.

Table 9-1 Temporary Meter Site Locations

Site	Location	Install Date
1	1151 Edgewater Avenue	3/23/17
2	1151 Edgewater Avenue	3/9/17
3	South Dean Street at Honeck Street	3/22/17
4	Nordhoff Place	3/10/17
5	Bergen County Turnpike	3/8/17
6	151 River Lane	3/9/17
7	Hackensack Avenue Shopping Mall	3/9/17
8	20 Empire Boulevard	3/7/17
9	Overpeck County Park	3/8/17
10	Overpark County Park R.O.W.	3/8/17

Table 9-1 notes the temporary meters sites and the dated that each meter was installed. Overall the meters were installed between March 8, 2017 and all meters were installed by March 23, 2017. Metering was conducted from Mid-March until Early September.

A meter site information field log was established for each of the metering locations. The information included pictures, text, and schematics illustrating the location, meter site number, aerial photo of the site, photos from top of the manhole and internally, as well as information on the pipe sizes, pipe shapes, and depth of manhole. The field log and daily flow monitoring data for each meter site is described in Section 9.1 thru 9.10.

9.1 Meter Site No. 1

Flow metering was conducted on the lower end of the Overpeck Valley Trunk Sewer at, and just downstream of the last junction chamber before the WPCF. The meter location was moved upstream from the original position due to hydraulics and access issues. (See Plate 1)

FLOW
ASSESSMENT SERVICES

METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	DATE: March 23, 2017	JOB#: 16095
LOCATION: 1151 Edgewater Avenue	MH#:	METER SITE: 1
GPS/COMMENTS: 40.836854, -74.016838		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	60	RCP	30	0	Circular	21' 00"
Incoming	72	PVC	30	0	Circular	21' 00"
Outgoing	72	PVC	30	0	Circular	21' 00"
Outgoing	60	RCP	13	0	Circular	20' 00"

SURCHARGE INFORMATION		WEIR INFORMATION
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

Plate 1

Table 9-2 Summary Flow Report Temp Meter Site 1

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/23/2017 (Thu)	-1.354	-0.635	-0.545			
3/24/2017 (Fri)	-1.563	-0.508	-0.995			
3/25/2017 (Sat)	-1.448	-0.272	-0.874			
3/26/2017 (Sun)	-1.568	-0.335	-0.882			
3/27/2017 (Mon)	-1.442	1.240	-0.536			
3/28/2017 (Tue)	-1.484	3.147	-0.367			
3/29/2017 (Wed)	-1.335	0.962	-0.447			
3/30/2017 (Thu)	-1.473	-0.287	-0.880			
3/31/2017 (Fri)	**-1.917**	**10.074**	**2.232**			
		Total for period	-3.295			
		Min:	-1.917			
		Avg:	-0.366			
		Max:	10.074			

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Summary Flow Report

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	1.061	6.388	2.514			
4/2/2017 (Sun)	0.866	1.814	0.512			
4/3/2017 (Mon)	-1.317	1.119	-0.341			
4/4/2017 (Tue)	-0.792	**10.846**	**3.883**			
4/5/2017 (Wed)	0.000	2.501	0.982			
4/6/2017 (Thu)	-1.162	7.932	1.827			
4/7/2017 (Fri)	0.000	3.388	1.474			
4/8/2017 (Sat)	-0.999	1.801	0.375			
4/9/2017 (Sun)	-1.108	1.401	-0.019			
4/10/2017 (Mon)	-1.341	0.856	-0.451			
4/11/2017 (Tue)	-1.484	0.000	-0.702			
4/12/2017 (Wed)	-1.596	0.000	-0.875			
4/13/2017 (Thu)	-1.509	0.000	-0.923			
4/14/2017 (Fri)	-1.578	0.000	-0.954			
4/15/2017 (Sat)	-1.465	0.000	-0.790			
4/16/2017 (Sun)	-1.389	0.000	-0.704			
4/17/2017 (Mon)	-1.547	-0.504	-0.973			
4/18/2017 (Tue)	-1.476	-0.411	-0.946			
4/19/2017 (Wed)	-1.377	-0.456	-0.942			
4/20/2017 (Thu)	-1.526	-0.520	-0.962			
4/21/2017 (Fri)	**-1.882**	0.232	-0.989			
4/22/2017 (Sat)	-1.536	-0.473	-0.931			
4/23/2017 (Sun)	-1.389	-0.477	-0.891			
4/24/2017 (Mon)	-1.485	-0.592	-1.060			
4/25/2017 (Tue)	-1.604	2.489	-0.563			
4/26/2017 (Wed)	-1.665	1.436	-0.567			
4/27/2017 (Thu)	-1.562	-0.275	-1.032			
4/28/2017 (Fri)	-1.566	-0.467	-1.043			
4/29/2017 (Sat)	-1.445	-0.413	-0.918			
4/30/2017 (Sun)	-1.472	-0.582	-0.868			
		Total for period	-6.878			
		Min:	-1.882			
		Avg:	-0.229			
		Max:	10.846			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	-1.434	-0.522	-0.997			
5/2/2017 (Tue)	-1.517	-0.693	-1.048			
5/3/2017 (Wed)	-1.566	-0.697	-1.091			
5/4/2017 (Thu)	-1.673	-0.428	-1.169			
5/5/2017 (Fri)	-1.765	**34.882**	10.852			
5/6/2017 (Sat)	**-47.899**	28.855	**11.525**			
5/7/2017 (Sun)	-1.443	2.271	0.064			
5/8/2017 (Mon)	-1.619	0.461	-0.626			
5/9/2017 (Tue)	-1.762	-0.331	-1.056			
5/10/2017 (Wed)	-1.820	-0.437	-1.054			
5/11/2017 (Thu)	-1.723	-0.373	-1.163			
5/12/2017 (Fri)	-1.785	-0.445	-1.148			
5/13/2017 (Sat)	-1.791	11.771	1.609			
5/14/2017 (Sun)	0.387	5.661	1.667			
5/15/2017 (Mon)	-1.329	1.168	-0.107			
5/16/2017 (Tue)	-1.643	0.226	-0.836			
5/17/2017 (Wed)	-1.655	-0.165	-0.977			
5/18/2017 (Thu)	-1.646	-0.353	-1.057			
5/19/2017 (Fri)	-1.712	-0.391	-1.162			
5/20/2017 (Sat)	-1.783	-0.564	-1.167			
5/21/2017 (Sun)	-1.661	-0.570	-1.091			
5/22/2017 (Mon)	-1.846	-0.489	-1.119			
5/23/2017 (Tue)	-1.853	-0.769	-1.312			
5/24/2017 (Wed)	-1.833	-0.139	-1.227			
5/25/2017 (Thu)	-2.035	5.696	-0.352			
5/26/2017 (Fri)	-1.586	2.108	-0.876			
5/27/2017 (Sat)	-1.580	-0.480	-1.156			
5/28/2017 (Sun)	-1.612	-0.712	-1.188			
5/29/2017 (Mon)	-1.596	-0.638	-1.141			
5/30/2017 (Tue)	-1.824	-0.260	-1.229			
5/31/2017 (Wed)	-2.119	-0.526	-1.308			
		Total for period	-1.160			
		Min:	-47.899			
		Avg:	-0.037			
		Max:	34.882			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	-1.831	-0.486	-1.364			
6/2/2017 (Fri)	-1.867	0.325	-1.261			
6/3/2017 (Sat)	-1.695	0.374	-1.134			
6/4/2017 (Sun)	-1.661	0.252	-1.158			
6/5/2017 (Mon)	-2.053	0.349	-1.311			
6/6/2017 (Tue)	-2.017	0.438	-1.345			
6/7/2017 (Wed)	-1.834	0.433	-1.261			
6/8/2017 (Thu)	-1.915	0.373	-1.343			
6/9/2017 (Fri)	-1.923	-0.401	-1.368			
6/10/2017 (Sat)	-1.733	0.306	-1.218			
6/11/2017 (Sun)	-1.753	0.146	-1.113			
6/12/2017 (Mon)	-2.004	0.170	-1.325			
6/13/2017 (Tue)	-1.906	-0.325	-1.356			
6/14/2017 (Wed)	**-2.653**	-0.358	-1.555			
6/15/2017 (Thu)	-1.947	0.260	-1.345			
6/16/2017 (Fri)	-1.903	0.229	-1.293			
6/17/2017 (Sat)	-1.643	**3.485**	-0.878			
6/18/2017 (Sun)	-1.665	0.227	-1.084			
6/19/2017 (Mon)	-2.503	2.969	**-0.782**			
6/20/2017 (Tue)	-2.108	-1.266	-1.655			
6/21/2017 (Wed)	-2.006	-0.696	-1.496			
6/22/2017 (Thu)	-2.093	-0.226	-1.422			
6/23/2017 (Fri)	-2.020	-0.204	-1.443			
6/24/2017 (Sat)	-2.531	1.830	-0.983			
6/25/2017 (Sun)	-1.807	-0.409	-1.332			
6/26/2017 (Mon)	-1.880	-0.441	-1.449			
6/27/2017 (Tue)	-2.423	-0.418	-1.501			
6/28/2017 (Wed)	-2.015	-0.452	-1.432			
6/29/2017 (Thu)	-1.886	-0.415	-1.413			
6/30/2017 (Fri)	-2.034	-0.416	-1.463			
		Total for period	-39.085			
		Min:	-2.653			
		Avg:	-1.303			
		Max:	3.485			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	-2.131	-0.583	-1.340			
7/2/2017 (Sun)	-1.660	0.199	-1.196			
7/3/2017 (Mon)	-2.255	0.516	-1.301			
7/4/2017 (Tue)	-1.674	0.458	-1.168			
7/5/2017 (Wed)	-1.967	-0.384	-1.407			
7/6/2017 (Thu)	-1.930	-0.353	-1.370			
7/7/2017 (Fri)	**-2.810**	**2.676**	-0.901			
7/8/2017 (Sat)	-1.910	-0.836	-1.525			
7/9/2017 (Sun)	-1.793	0.394	-1.178			
7/10/2017 (Mon)	-1.894	-0.331	-1.386			
7/11/2017 (Tue)	-1.900	0.367	-1.311			
7/12/2017 (Wed)	-2.034	-0.449	-1.414			
7/13/2017 (Thu)	-2.074	0.215	-1.379			
7/14/2017 (Fri)	-1.970	1.074	**-0.854**			
7/15/2017 (Sat)	-1.799	-0.659	-1.399			
7/16/2017 (Sun)	-1.665	0.224	-1.145			
7/17/2017 (Mon)	-1.880	0.357	-1.263			
7/18/2017 (Tue)	-2.137	0.314	-1.341			
7/19/2017 (Wed)	-1.973	0.271	-1.369			
7/20/2017 (Thu)	-2.273	0.242	-1.483			
7/21/2017 (Fri)	-2.166	0.318	-1.367			
7/22/2017 (Sat)	-2.477	0.225	-1.253			
7/23/2017 (Sun)	-2.233	-0.450	-1.375			
7/24/2017 (Mon)	-2.775	1.168	-1.115			
7/25/2017 (Tue)	-2.128	-0.652	-1.481			
7/26/2017 (Wed)	-2.188	0.333	-1.400			
7/27/2017 (Thu)	-2.165	-0.336	-1.436			
7/28/2017 (Fri)	-2.023	-0.334	-1.402			
7/29/2017 (Sat)	-1.977	0.337	-1.333			
7/30/2017 (Sun)	-1.786	0.400	-1.139			
7/31/2017 (Mon)	-1.926	0.476	-1.314			
		Total for period	-40.344			
		Min:	-2.810			
		Avg:	-1.301			
		Max:	2.676			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	-1.977	0.227	-1.345			
8/2/2017 (Wed)	-2.022	1.328	-0.962			
8/3/2017 (Thu)	-1.944	-0.448	-1.457			
8/4/2017 (Fri)	-2.254	-0.097	-1.449			
8/5/2017 (Sat)	-2.435	0.297	-1.381			
8/6/2017 (Sun)	-1.780	0.337	-1.055			
8/7/2017 (Mon)	-2.350	2.482	-0.679			
8/8/2017 (Tue)	-2.040	-0.610	-1.503			
8/9/2017 (Wed)	-2.026	-0.473	-1.419			
8/10/2017 (Thu)	-1.969	0.186	-1.388			
8/11/2017 (Fri)	-1.953	-0.343	-1.392			
8/12/2017 (Sat)	-2.033	-0.495	-1.436			
8/13/2017 (Sun)	-1.769	0.368	-1.213			
8/14/2017 (Mon)	-1.962	0.252	-1.218			
8/15/2017 (Tue)	-2.373	0.317	-1.480			
8/16/2017 (Wed)	-2.027	0.498	-1.260			
8/17/2017 (Thu)	-1.964	0.509	-1.356			
8/18/2017 (Fri)	-1.806	**5.941**	-0.403			
8/19/2017 (Sat)	-1.749	-0.378	-1.330			
8/20/2017 (Sun)	-1.672	-0.426	-1.224			
8/21/2017 (Mon)	-1.967	-0.367	-1.402			
8/22/2017 (Tue)	-2.000	-0.412	-1.396			
8/23/2017 (Wed)	-2.193	-0.476	-1.507			
8/24/2017 (Thu)	-1.889	-0.404	-1.405			
8/25/2017 (Fri)	-2.192	-0.376	-1.452			
8/26/2017 (Sat)	-1.831	-0.362	-1.321			
8/27/2017 (Sun)	-1.777	0.238	-1.211			
8/28/2017 (Mon)	-2.158	-0.459	-1.448			
8/29/2017 (Tue)	**-2.446**	-0.527	-1.505			
8/30/2017 (Wed)	-2.135	-0.480	-1.511			
8/31/2017 (Thu)	-2.080	0.337	-1.264			
9/1/2017 (Fri)	-2.077	0.319	-1.386			
9/2/2017 (Sat)	-1.915	0.253	-1.254			
9/3/2017 (Sun)	-2.324	-0.441	-1.320			
9/4/2017 (Mon)	-1.720	0.335	-1.058			
9/5/2017 (Tue)	-2.050	0.314	-1.173			
9/6/2017 (Wed)	-2.039	2.893	-1.017			
9/7/2017 (Thu)	-2.140	2.852	-1.420			
9/8/2017 (Fri)	-2.144	-0.453	-1.415			
9/9/2017 (Sat)	-1.744	-0.284	-1.224			
9/10/2017 (Sun)	-1.786	-0.418	-1.179			
9/11/2017 (Mon)	-2.120	-0.385	-1.447			
9/12/2017 (Tue)	-2.173	-0.235	-1.420			
9/13/2017 (Wed)	-2.060	-0.376	**-0.366**			

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Summary Flow Report

Site:
1
1151 Edgewater Ave. Bergen County, NJ 60"circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			-56.252			
Min:			-2.446			
Avg:			-1.278			
Max:			5.941			

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9.2 Meter Site No. 2

Flow metering was conducted on the lower end of the Overpeck Valley Relief Sewer at, and just downstream of the last junction chamber before the WPCF (See Plate 2).

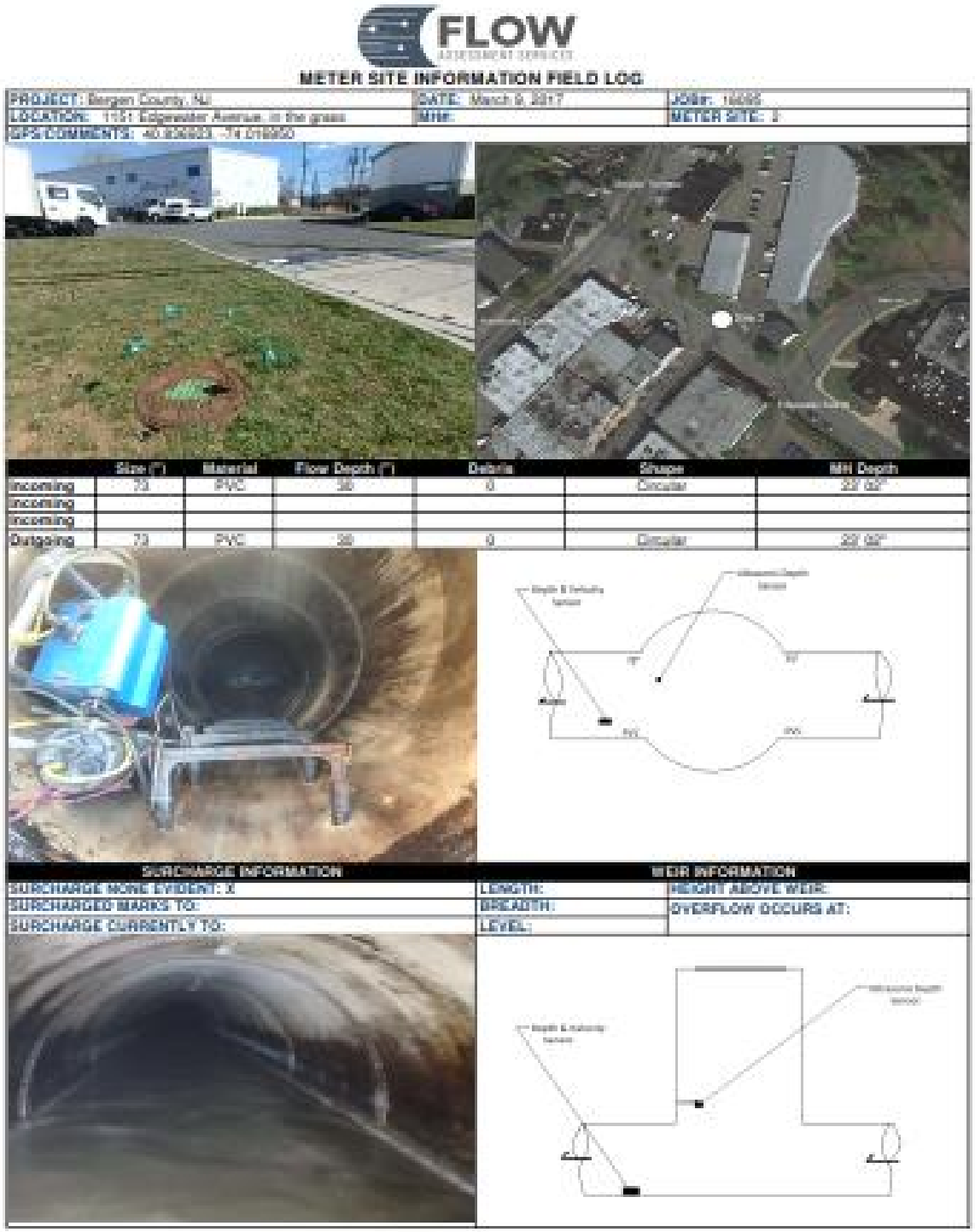

Plate 2

Table 9-3 Summary Flow Report Temp Meter Site 2

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/9/2017 (Thu)	17.177	29.982	11.342			
3/10/2017 (Fri)	9.678	31.104	22.334			
3/11/2017 (Sat)	10.978	31.339	21.412			
3/12/2017 (Sun)	11.511	30.186	21.404			
3/13/2017 (Mon)	9.439	28.823	20.095			
3/14/2017 (Tue)	10.222	29.715	20.640			
3/15/2017 (Wed)	**9.379**	28.756	21.121			
3/16/2017 (Thu)	9.588	29.788	21.208			
3/17/2017 (Fri)	10.401	31.703	22.760			
3/18/2017 (Sat)	10.585	31.534	22.949			
3/19/2017 (Sun)	11.535	36.772	25.669			
3/20/2017 (Mon)	14.472	35.631	26.520			
3/21/2017 (Tue)	14.282	38.437	28.519			
3/22/2017 (Wed)	18.255	36.974	28.703			
3/23/2017 (Thu)	11.950	32.729	25.403			
3/24/2017 (Fri)	12.917	34.275	24.768			
3/25/2017 (Sat)	15.691	33.298	25.473			
3/26/2017 (Sun)	15.753	35.309	25.743			
3/27/2017 (Mon)	14.683	42.733	27.695			
3/28/2017 (Tue)	15.573	47.101	29.430			
3/29/2017 (Wed)	22.780	38.529	30.371			
3/30/2017 (Thu)	15.129	34.519	27.228			
3/31/2017 (Fri)	20.552	**55.331**	**39.587**			
		Total for period	570.374			
		Min:	9.379			
		Avg:	24.799			
		Max:	55.331			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	32.350	53.106	41.367			
4/2/2017 (Sun)	23.972	43.578	33.085			
4/3/2017 (Mon)	18.774	38.776	29.587			
4/4/2017 (Tue)	26.534	**64.589**	**43.681**			
4/5/2017 (Wed)	24.705	42.261	33.922			
4/6/2017 (Thu)	21.580	57.894	36.767			
4/7/2017 (Fri)	25.296	44.238	35.810			
4/8/2017 (Sat)	23.660	42.517	32.140			
4/9/2017 (Sun)	21.490	37.015	29.910			
4/10/2017 (Mon)	18.445	35.458	28.209			
4/11/2017 (Tue)	16.732	35.296	27.073			
4/12/2017 (Wed)	16.790	34.625	26.547			
4/13/2017 (Thu)	14.119	33.503	25.168			
4/14/2017 (Fri)	16.201	32.449	24.793			
4/15/2017 (Sat)	13.976	33.094	24.497			
4/16/2017 (Sun)	14.920	33.492	24.256			
4/17/2017 (Mon)	12.616	30.431	23.566			
4/18/2017 (Tue)	12.016	29.783	22.843			
4/19/2017 (Wed)	**11.137**	31.579	22.568			
4/20/2017 (Thu)	11.273	33.351	23.302			
4/21/2017 (Fri)	15.116	33.847	25.097			
4/22/2017 (Sat)	12.700	31.980	23.270			
4/23/2017 (Sun)	12.944	31.146	22.790			
4/24/2017 (Mon)	11.391	31.096	22.206			
4/25/2017 (Tue)	11.441	46.279	25.778			
4/26/2017 (Wed)	17.163	40.163	30.289			
4/27/2017 (Thu)	15.493	34.252	26.408			
4/28/2017 (Fri)	15.161	33.891	25.130			
4/29/2017 (Sat)	13.231	33.616	24.421			
4/30/2017 (Sun)	13.721	32.978	23.656			
		Total for period	838.126			
		Min:	11.137			
		Avg:	27.938			
		Max:	64.589			

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Summary Flow Report

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	12.660	30.959	23.146			
5/2/2017 (Tue)	12.846	31.404	22.959			
5/3/2017 (Wed)	10.869	29.116	22.047			
5/4/2017 (Thu)	11.745	30.907	21.595			
5/5/2017 (Fri)	**10.689**	**81.792**	33.193			
5/6/2017 (Sat)	17.004	53.292	29.691			
5/7/2017 (Sun)	23.459	40.156	31.734			
5/8/2017 (Mon)	19.284	35.793	28.639			
5/9/2017 (Tue)	16.713	36.911	27.050			
5/10/2017 (Wed)	12.690	32.499	25.967			
5/11/2017 (Thu)	13.502	31.995	25.111			
5/12/2017 (Fri)	13.857	31.014	24.873			
5/13/2017 (Sat)	14.130	59.235	34.932			
5/14/2017 (Sun)	29.182	51.570	**36.911**			
5/15/2017 (Mon)	20.897	37.744	30.381			
5/16/2017 (Tue)	17.626	37.392	28.112			
5/17/2017 (Wed)	15.711	35.457	26.859			
5/18/2017 (Thu)	14.384	33.484	26.190			
5/19/2017 (Fri)	13.924	33.555	25.412			
5/20/2017 (Sat)	13.398	31.694	23.966			
5/21/2017 (Sun)	14.632	33.087	24.200			
5/22/2017 (Mon)	14.494	37.566	26.847			
5/23/2017 (Tue)	11.929	33.443	24.818			
5/24/2017 (Wed)	11.728	32.076	24.368			
5/25/2017 (Thu)	12.516	42.881	27.906			
5/26/2017 (Fri)	23.658	38.424	29.671			
5/27/2017 (Sat)	14.359	33.393	24.858			
5/28/2017 (Sun)	14.402	33.646	23.829			
5/29/2017 (Mon)	14.594	33.944	24.335			
5/30/2017 (Tue)	13.793	31.202	23.876			
5/31/2017 (Wed)	13.384	32.911	24.302			
		Total for period	827.888			
		Min:	10.689			
		Avg:	26.706			
		Max:	81.792			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	12.665	31.623	23.799			
6/2/2017 (Fri)	12.907	30.733	22.743			
6/3/2017 (Sat)	12.541	31.653	22.059			
6/4/2017 (Sun)	12.420	31.273	22.417			
6/5/2017 (Mon)	12.411	31.905	22.873			
6/6/2017 (Tue)	11.211	31.570	22.867			
6/7/2017 (Wed)	10.215	30.328	21.869			
6/8/2017 (Thu)	10.775	31.283	21.666			
6/9/2017 (Fri)	10.411	29.357	21.415			
6/10/2017 (Sat)	**9.259**	30.491	20.938			
6/11/2017 (Sun)	11.803	30.378	21.329			
6/12/2017 (Mon)	11.796	29.276	21.532			
6/13/2017 (Tue)	10.571	28.475	21.085			
6/14/2017 (Wed)	13.296	29.951	21.876			
6/15/2017 (Thu)	10.533	28.526	20.540			
6/16/2017 (Fri)	10.347	27.025	20.497			
6/17/2017 (Sat)	10.023	41.517	23.132			
6/18/2017 (Sun)	10.945	31.197	21.739			
6/19/2017 (Mon)	11.580	49.786	25.960			
6/20/2017 (Tue)	14.474	31.200	24.889			
6/21/2017 (Wed)	11.283	30.119	22.393			
6/22/2017 (Thu)	11.917	29.108	21.490			
6/23/2017 (Fri)	10.842	28.949	21.615			
6/24/2017 (Sat)	16.506	**50.869**	**28.627**			
6/25/2017 (Sun)	13.460	32.062	23.074			
6/26/2017 (Mon)	12.700	27.561	21.992			
6/27/2017 (Tue)	12.912	27.941	22.231			
6/28/2017 (Wed)	10.476	28.196	20.977			
6/29/2017 (Thu)	10.632	29.067	20.848			
6/30/2017 (Fri)	10.899	28.177	20.503			
		Total for period	668.975			
		Min:	9.259			
		Avg:	22.299			
		Max:	50.869			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	10.115	31.157	20.958			
7/2/2017 (Sun)	11.809	28.927	20.150			
7/3/2017 (Mon)	11.719	26.488	19.901			
7/4/2017 (Tue)	12.380	26.197	20.641			
7/5/2017 (Wed)	11.634	24.498	20.038			
7/6/2017 (Thu)	11.383	23.912	19.648			
7/7/2017 (Fri)	11.276	**46.345**	25.403			
7/8/2017 (Sat)	14.132	26.816	21.615			
7/9/2017 (Sun)	11.808	25.724	19.946			
7/10/2017 (Mon)	11.383	24.067	19.581			
7/11/2017 (Tue)	11.444	21.079	3.539			
7/12/2017 (Wed)						
7/13/2017 (Thu)						
7/14/2017 (Fri)						
7/15/2017 (Sat)	21.732	26.286	9.661			
7/16/2017 (Sun)	12.331	26.341	20.845			
7/17/2017 (Mon)	12.039	24.911	20.481			
7/18/2017 (Tue)	11.906	24.798	20.225			
7/19/2017 (Wed)	11.410	24.517	19.857			
7/20/2017 (Thu)	11.193	25.990	19.688			
7/21/2017 (Fri)	8.975	26.611	19.427			
7/22/2017 (Sat)	9.501	28.063	19.118			
7/23/2017 (Sun)	12.050	33.375	21.854			
7/24/2017 (Mon)	9.348	42.194	**26.248**			
7/25/2017 (Tue)	11.085	25.928	20.283			
7/26/2017 (Wed)	10.514	25.020	19.708			
7/27/2017 (Thu)	9.986	24.694	19.257			
7/28/2017 (Fri)	**8.628**	24.075	19.223			
7/29/2017 (Sat)	8.965	25.551	18.478			
7/30/2017 (Sun)	9.747	24.532	18.400			
7/31/2017 (Mon)	9.593	26.044	18.911			
		Total for period	543.105			
		Min:	8.628			
		Avg:	19.397			
		Max:	46.345			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
2
1151 Edgewater Avenue, in the grass Bergen County, NJ 73" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	9.366	25.027	18.474			
8/2/2017 (Wed)	**9.064**	**44.698**	**22.068**			
8/3/2017 (Thu)	10.506	26.383	7.100			
		Total for period	47.642			
		Min:	9.064			
		Avg:	15.881			
		Max:	44.698			

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9.3 Meter Site No. 3

Flow metering was conducted on the upper end of the Overpeck Valley Trunk Sewer in Englewood as an upper boundary condition to the model. (See Plate 3)

Plate 3

Table 9-4 Summary Flow Report Temp Meter Site 3

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Hancock St. Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/22/2017 (Wed)	1.197	1.913	0.382			
3/23/2017 (Thu)	0.697	2.029	1.446			
3/24/2017 (Fri)	**0.611**	1.956	1.437			
3/25/2017 (Sat)	0.732	2.209	1.399			
3/26/2017 (Sun)	0.697	2.242	1.469			
3/27/2017 (Mon)	0.728	2.717	1.666			
3/28/2017 (Tue)	0.921	3.479	1.798			
3/29/2017 (Wed)	1.122	2.650	1.829			
3/30/2017 (Thu)	0.859	2.269	1.611			
3/31/2017 (Fri)	0.958	**4.279**	**2.517**			
		Total for period	15.554			
		Min:	0.611			
		Avg:	1.555			
		Max:	4.279			

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Summary Flow Report

Site:
3
South Dean St. at Honeck St. Bergen County, NJ 42" circular line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	2.022	3.716	2.746			
4/2/2017 (Sun)	1.332	3.458	2.265			
4/3/2017 (Mon)	1.179	2.831	2.031			
4/4/2017 (Tue)	1.317	**5.055**	**3.197**			
4/5/2017 (Wed)	1.667	3.457	2.584			
4/6/2017 (Thu)	1.441	4.640	2.796			
4/7/2017 (Fri)	1.791	3.576	2.769			
4/8/2017 (Sat)	1.420	3.236	2.328			
4/9/2017 (Sun)	1.256	3.110	2.148			
4/10/2017 (Mon)	0.860	2.703	2.018			
4/11/2017 (Tue)	1.112	2.447	1.851			
4/12/2017 (Wed)	0.839	2.264	1.641			
4/13/2017 (Thu)	0.716	2.312	1.613			
4/14/2017 (Fri)	0.744	2.293	1.582			
4/15/2017 (Sat)	0.704	2.162	1.461			
4/16/2017 (Sun)	0.668	2.287	1.432			
4/17/2017 (Mon)	0.567	1.866	1.266			
4/18/2017 (Tue)	0.420	1.954	1.210			
4/19/2017 (Wed)	**0.383**	2.032	1.307			
4/20/2017 (Thu)	0.563	2.077	1.304			
4/21/2017 (Fri)	0.600	2.128	1.383			
4/22/2017 (Sat)	0.498	2.031	1.242			
4/23/2017 (Sun)	0.446	2.151	1.257			
4/24/2017 (Mon)	0.435	1.876	1.234			
4/25/2017 (Tue)	0.656	2.707	1.483			
4/26/2017 (Wed)	1.025	2.240	1.623			
4/27/2017 (Thu)	0.905	2.020	1.519			
4/28/2017 (Fri)	0.694	2.238	1.442			
4/29/2017 (Sat)	0.621	2.241	1.381			
4/30/2017 (Sun)	0.573	1.975	1.337			
		Total for period	53.409			
		Min:	0.383			
		Avg:	1.780			
		Max:	5.055			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Honeck St. Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	0.529	1.922	1.299			
5/2/2017 (Tue)	0.537	1.978	1.282			
5/3/2017 (Wed)	0.474	1.931	1.184			
5/4/2017 (Thu)	0.390	1.840	1.141			
5/5/2017 (Fri)	**0.366**	**6.393**	**2.575**			
5/6/2017 (Sat)	1.685	3.403	2.439			
5/7/2017 (Sun)	1.217	3.079	2.033			
5/8/2017 (Mon)	0.970	2.752	1.864			
5/9/2017 (Tue)	0.793	2.405	1.614			
5/10/2017 (Wed)	0.649	2.233	1.499			
5/11/2017 (Thu)	0.653	2.202	1.449			
5/12/2017 (Fri)	0.614	2.158	1.397			
5/13/2017 (Sat)	0.604	3.927	1.987			
5/14/2017 (Sun)	1.576	3.227	2.314			
5/15/2017 (Mon)	1.151	2.833	1.928			
5/16/2017 (Tue)	0.894	2.606	1.729			
5/17/2017 (Wed)	0.831	2.479	1.617			
5/18/2017 (Thu)	0.767	2.495	1.566			
5/19/2017 (Fri)	0.665	2.232	1.476			
5/20/2017 (Sat)	0.590	2.002	1.347			
5/21/2017 (Sun)	0.592	2.268	1.418			
5/22/2017 (Mon)	0.551	2.149	1.454			
5/23/2017 (Tue)	0.627	2.084	1.378			
5/24/2017 (Wed)	0.532	2.105	1.300			
5/25/2017 (Thu)	0.525	2.504	1.422			
5/26/2017 (Fri)	0.911	2.224	1.597			
5/27/2017 (Sat)	0.650	2.180	1.340			
5/28/2017 (Sun)	0.578	1.990	1.290			
5/29/2017 (Mon)	0.505	2.187	1.314			
5/30/2017 (Tue)	0.511	2.020	1.293			
5/31/2017 (Wed)	0.472	2.001	1.287			
		Total for period	46.813			
		Min:	0.366			
		Avg:	1.575			
		Max:	6.393			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Honeck St. Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	0.516	1.966	1.226			
6/2/2017 (Fri)	0.416	1.799	1.200			
6/3/2017 (Sat)	0.424	1.923	1.092			
6/4/2017 (Sun)	0.383	1.833	1.127			
6/5/2017 (Mon)	0.366	1.740	1.125			
6/6/2017 (Tue)	0.352	1.751	1.080			
6/7/2017 (Wed)	0.296	1.681	1.057			
6/8/2017 (Thu)	0.348	1.722	1.060			
6/9/2017 (Fri)	0.351	1.623	1.061			
6/10/2017 (Sat)	0.331	1.794	0.996			
6/11/2017 (Sun)	0.304	1.699	1.035			
6/12/2017 (Mon)	0.271	1.573	1.022			
6/13/2017 (Tue)	0.252	1.559	1.035			
6/14/2017 (Wed)	0.290	1.525	1.006			
6/15/2017 (Thu)	0.223	1.629	1.003			
6/16/2017 (Fri)	0.253	1.646	1.038			
6/17/2017 (Sat)	0.334	1.802	1.061			
6/18/2017 (Sun)	0.333	1.807	1.077			
6/19/2017 (Mon)	0.326	2.131	1.177			
6/20/2017 (Tue)	0.368	1.759	1.076			
6/21/2017 (Wed)	0.282	1.653	1.056			
6/22/2017 (Thu)	0.318	1.595	1.034			
6/23/2017 (Fri)	0.319	1.587	1.037			
6/24/2017 (Sat)	0.477	**3.176**	**1.325**			
6/25/2017 (Sun)	0.291	1.694	1.036			
6/26/2017 (Mon)	0.221	1.597	0.991			
6/27/2017 (Tue)	**0.215**	1.594	0.998			
6/28/2017 (Wed)	0.232	1.613	0.968			
6/29/2017 (Thu)	0.225	1.484	0.951			
6/30/2017 (Fri)	0.229	1.599	0.968			
		Total for period	31.939			
		Min:	0.215			
		Avg:	1.065			
		Max:	3.176			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Honeck St. - Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	0.263	1.493	0.930			
7/2/2017 (Sun)	0.279	1.530	0.925			
7/3/2017 (Mon)	0.207	1.609	0.955			
7/4/2017 (Tue)	0.269	1.592	0.933			
7/5/2017 (Wed)	0.240	1.365	0.901			
7/6/2017 (Thu)	0.245	1.445	0.923			
7/7/2017 (Fri)	0.200	**3.095**	**1.211**			
7/8/2017 (Sat)	0.368	1.693	1.073			
7/9/2017 (Sun)	0.264	1.536	0.939			
7/10/2017 (Mon)	0.233	1.428	0.925			
7/11/2017 (Tue)	0.300	1.469	0.960			
7/12/2017 (Wed)	0.210	1.413	0.916			
7/13/2017 (Thu)	0.217	1.411	0.901			
7/14/2017 (Fri)	0.213	2.037	1.064			
7/15/2017 (Sat)	0.285	1.567	0.950			
7/16/2017 (Sun)	0.232	1.473	0.908			
7/17/2017 (Mon)	0.219	1.404	0.915			
7/18/2017 (Tue)	0.203	1.420	0.916			
7/19/2017 (Wed)	0.182	1.428	0.888			
7/20/2017 (Thu)	0.188	1.443	0.878			
7/21/2017 (Fri)	0.181	1.396	0.877			
7/22/2017 (Sat)	0.196	1.356	0.819			
7/23/2017 (Sun)	0.190	1.589	0.893			
7/24/2017 (Mon)	0.162	3.067	1.154			
7/25/2017 (Tue)	0.250	1.438	0.921			
7/26/2017 (Wed)	0.181	1.483	0.890			
7/27/2017 (Thu)	0.225	1.357	0.885			
7/28/2017 (Fri)	0.203	1.453	0.907			
7/29/2017 (Sat)	0.215	1.423	0.795			
7/30/2017 (Sun)	**0.152**	1.344	0.797			
7/31/2017 (Mon)	0.171	1.273	0.813			
		Total for period	28.754			
		Min:	0.152			
		Avg:	0.928			
		Max:	3.095			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Honeck St. Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	0.166	1.273	0.784			
8/2/2017 (Wed)	0.140	2.318	0.917			
8/3/2017 (Thu)	0.196	1.296	0.828			
8/4/2017 (Fri)	0.148	1.461	0.852			
8/5/2017 (Sat)	0.155	1.431	0.803			
8/6/2017 (Sun)	0.110	1.295	0.762			
8/7/2017 (Mon)	0.120	1.721	0.942			
8/8/2017 (Tue)	0.241	1.393	0.891			
8/9/2017 (Wed)	0.183	1.316	0.854			
8/10/2017 (Thu)	0.139	1.233	0.808			
8/11/2017 (Fri)	0.156	1.349	0.794			
8/12/2017 (Sat)	0.246	1.296	0.772			
8/13/2017 (Sun)	0.143	1.338	0.766			
8/14/2017 (Mon)	0.129	1.351	0.813			
8/15/2017 (Tue)	0.230	1.350	0.834			
8/16/2017 (Wed)	0.152	1.283	0.805			
8/17/2017 (Thu)	0.134	1.297	0.777			
8/18/2017 (Fri)	0.138	**6.228**	**1.553**			
8/19/2017 (Sat)	0.294	1.522	0.937			
8/20/2017 (Sun)	0.216	1.472	0.858			
8/21/2017 (Mon)	0.195	1.317	0.854			
8/22/2017 (Tue)	0.205	1.316	0.874			
8/23/2017 (Wed)	0.219	1.385	0.863			
8/24/2017 (Thu)	0.219	1.346	0.812			
8/25/2017 (Fri)	0.193	1.312	0.808			
8/26/2017 (Sat)	0.150	1.308	0.726			
8/27/2017 (Sun)	0.121	1.319	0.737			
8/28/2017 (Mon)	0.144	1.250	0.749			
8/29/2017 (Tue)	0.136	1.214	0.749			
8/30/2017 (Wed)	0.137	1.214	0.750			
8/31/2017 (Thu)	0.133	0.996	0.634			
9/1/2017 (Fri)	0.132	1.262	0.715			
9/2/2017 (Sat)	0.119	1.290	0.729			
9/3/2017 (Sun)	0.406	1.819	1.018			
9/4/2017 (Mon)	0.204	1.634	0.879			
9/5/2017 (Tue)	0.219	1.832	0.878			
9/6/2017 (Wed)	0.182	1.524	0.894			
9/7/2017 (Thu)	0.295	1.584	0.942			
9/8/2017 (Fri)	0.175	1.475	0.841			
9/9/2017 (Sat)	0.182	1.563	0.812			
9/10/2017 (Sun)	0.147	1.603	0.849			
9/11/2017 (Mon)	0.145	1.413	0.821			
9/12/2017 (Tue)	0.115	1.440	0.792			
9/13/2017 (Wed)	**0.000**	1.381	0.352			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
3
South Dean St. at Horeck St. Bergen County, NJ 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			36.426			
Min:			0.000			
Avg:			0.828			
Max:			6.228			

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9.4 Meter Site No. 4

Flow metering was conducted on the upper end of the Overpeck Valley Relief Sewer in Englewood as an upper boundary condition to the model. (See Plate 4)

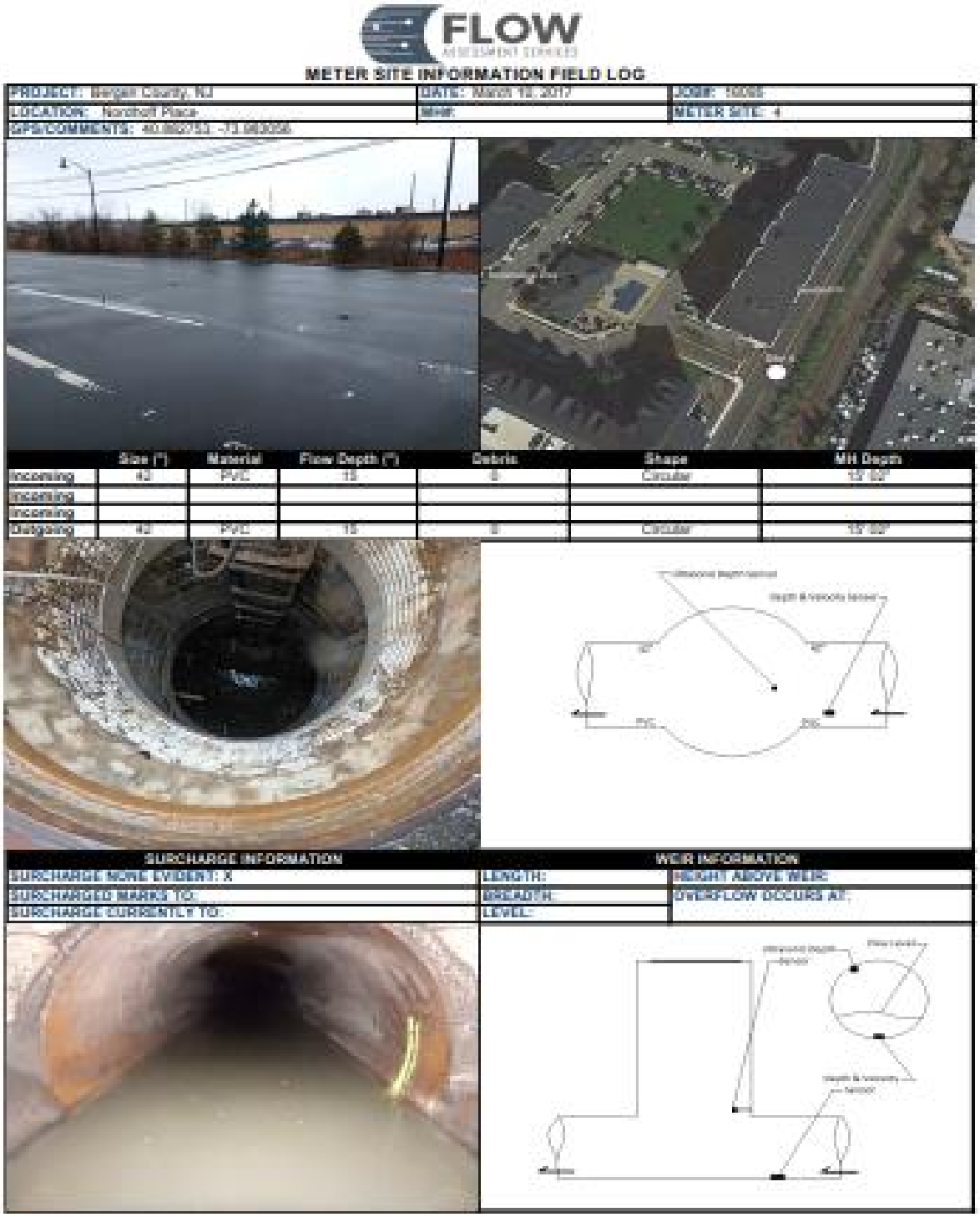

Plate 4

Table 9-5 Summary Flow Report Temp Meter Site 4

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place | Bergen County, NJ | 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/10/2017 (Fri)	2.403	3.928	1.654			
3/11/2017 (Sat)	2.142	3.883	3.006			
3/12/2017 (Sun)	2.099	4.184	3.068			
3/13/2017 (Mon)	**1.883**	3.781	3.048			
3/14/2017 (Tue)	2.117	3.926	3.025			
3/15/2017 (Wed)	2.025	3.896	3.059			
3/16/2017 (Thu)	2.037	3.810	3.056			
3/17/2017 (Fri)	2.011	3.807	3.062			
3/18/2017 (Sat)	2.043	3.921	3.092			
3/19/2017 (Sun)	2.205	4.359	3.233			
3/20/2017 (Mon)	2.281	4.177	3.313			
3/21/2017 (Tue)	2.450	4.307	3.389			
3/22/2017 (Wed)	2.525	4.801	3.466			
3/23/2017 (Thu)	2.572	4.198	3.448			
3/24/2017 (Fri)	2.423	4.141	3.434			
3/25/2017 (Sat)	2.584	4.246	3.430			
3/26/2017 (Sun)	2.424	4.482	3.518			
3/27/2017 (Mon)	2.531	4.808	3.540			
3/28/2017 (Tue)	2.829	5.286	3.717			
3/29/2017 (Wed)	2.857	4.767	3.768			
3/30/2017 (Thu)	2.636	4.534	3.657			
3/31/2017 (Fri)	2.772	**5.543**	**4.089**			
		Total for period	72.111			
		Min:	1.883			
		Avg:	3.278			
		Max:	5.543			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place | Bergen County, NJ | 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	3.170	5.394	4.265			
4/2/2017 (Sun)	3.001	4.850	4.091			
4/3/2017 (Mon)	2.650	4.843	3.987			
4/4/2017 (Tue)	2.237	**7.628**	**4.866**			
4/5/2017 (Wed)	3.365	5.398	4.391			
4/6/2017 (Thu)	3.144	6.675	4.481			
4/7/2017 (Fri)	3.207	5.467	4.497			
4/8/2017 (Sat)	3.088	5.153	4.190			
4/9/2017 (Sun)	3.063	5.110	4.089			
4/10/2017 (Mon)	2.900	4.846	3.975			
4/11/2017 (Tue)	2.737	4.734	3.881			
4/12/2017 (Wed)	2.863	4.713	3.735			
4/13/2017 (Thu)	2.707	4.688	3.679			
4/14/2017 (Fri)	2.791	4.651	3.657			
4/15/2017 (Sat)	2.572	4.517	3.603			
4/16/2017 (Sun)	2.779	4.491	3.649			
4/17/2017 (Mon)	2.664	4.234	3.507			
4/18/2017 (Tue)	2.507	4.288	3.428			
4/19/2017 (Wed)	2.374	4.204	3.369			
4/20/2017 (Thu)	2.474	4.205	3.429			
4/21/2017 (Fri)	2.587	4.480	3.493			
4/22/2017 (Sat)	2.429	4.072	3.345			
4/23/2017 (Sun)	**2.132**	4.256	3.334			
4/24/2017 (Mon)	2.194	4.034	3.258			
4/25/2017 (Tue)	2.141	4.714	3.334			
4/26/2017 (Wed)	2.570	4.462	3.574			
4/27/2017 (Thu)	2.523	4.289	3.471			
4/28/2017 (Fri)	2.273	4.267	3.421			
4/29/2017 (Sat)	2.280	4.210	3.390			
4/30/2017 (Sun)	2.237	4.252	3.341			
		Total for period	112.727			
		Min:	2.132			
		Avg:	3.758			
		Max:	7.628			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place | Bergen County, NJ | 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	2.030	4.166	3.310			
5/2/2017 (Tue)	2.205	4.082	3.259			
5/3/2017 (Wed)	2.123	3.936	3.111			
5/4/2017 (Thu)	2.070	4.057	3.088			
5/5/2017 (Fri)	2.100	**8.633**	**4.127**			
5/6/2017 (Sat)	2.577	5.085	3.911			
5/7/2017 (Sun)	2.532	4.764	3.845			
5/8/2017 (Mon)	2.676	4.566	3.734			
5/9/2017 (Tue)	2.417	4.603	3.511			
5/10/2017 (Wed)	2.358	4.346	3.476			
5/11/2017 (Thu)	2.339	4.344	3.448			
5/12/2017 (Fri)	2.283	4.221	3.314			
5/13/2017 (Sat)	2.257	5.225	3.459			
5/14/2017 (Sun)	2.631	5.038	3.726			
5/15/2017 (Mon)	2.497	4.645	3.616			
5/16/2017 (Tue)	1.885	4.766	3.416			
5/17/2017 (Wed)	2.595	4.317	3.498			
5/18/2017 (Thu)	2.319	4.384	3.466			
5/19/2017 (Fri)	2.211	4.311	3.340			
5/20/2017 (Sat)	2.245	3.957	3.188			
5/21/2017 (Sun)	2.281	4.130	3.260			
5/22/2017 (Mon)	2.205	4.173	3.289			
5/23/2017 (Tue)	2.030	4.162	3.192			
5/24/2017 (Wed)	1.810	3.939	3.152			
5/25/2017 (Thu)	1.985	4.183	3.139			
5/26/2017 (Fri)	2.156	4.152	3.201			
5/27/2017 (Sat)	1.880	3.909	3.036			
5/28/2017 (Sun)	**1.729**	4.032	2.989			
5/29/2017 (Mon)	2.026	4.090	2.954			
5/30/2017 (Tue)	1.917	4.203	2.950			
5/31/2017 (Wed)	1.869	4.234	3.018			
		Total for period	104.032			
		Min:	1.729			
		Avg:	3.358			
		Max:	8.633			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place | Bergen County, NJ | 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	1.783	3.833	2.927			
6/2/2017 (Fri)	1.672	3.945	2.970			
6/3/2017 (Sat)	2.000	3.846	2.959			
6/4/2017 (Sun)	1.605	3.929	2.940			
6/5/2017 (Mon)	1.580	3.861	2.954			
6/6/2017 (Tue)	1.550	3.901	2.820			
6/7/2017 (Wed)	1.885	4.052	2.934			
6/8/2017 (Thu)	1.575	3.707	2.925			
6/9/2017 (Fri)	1.867	3.945	2.920			
6/10/2017 (Sat)	1.666	3.929	2.866			
6/11/2017 (Sun)	1.731	4.077	2.862			
6/12/2017 (Mon)	1.614	3.994	2.808			
6/13/2017 (Tue)	1.769	3.716	2.878			
6/14/2017 (Wed)	1.815	3.700	2.922			
6/15/2017 (Thu)	1.939	3.740	2.897			
6/16/2017 (Fri)	**1.480**	3.950	2.923			
6/17/2017 (Sat)	2.051	3.645	2.890			
6/18/2017 (Sun)	1.748	3.817	2.946			
6/19/2017 (Mon)	1.588	3.922	2.918			
6/20/2017 (Tue)	1.765	4.159	2.918			
6/21/2017 (Wed)	1.948	3.865	2.993			
6/22/2017 (Thu)	2.032	3.725	2.966			
6/23/2017 (Fri)	2.105	3.875	3.014			
6/24/2017 (Sat)	1.611	**4.371**	**3.176**			
6/25/2017 (Sun)	2.045	3.996	3.063			
6/26/2017 (Mon)	1.999	3.938	3.101			
6/27/2017 (Tue)	1.979	3.811	3.023			
6/28/2017 (Wed)	1.902	3.879	3.020			
6/29/2017 (Thu)	2.002	3.948	3.018			
6/30/2017 (Fri)	2.074	3.764	2.991			
		Total for period	88.542			
		Min:	1.480			
		Avg:	2.951			
		Max:	4.371			

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Summary Flow Report

Site:
4
Nordhoff Place

Bergen County, NJ

42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	1.973	3.790	2.919			
7/2/2017 (Sun)	2.063	3.958	2.910			
7/3/2017 (Mon)	1.982	3.729	2.883			
7/4/2017 (Tue)	1.941	3.831	3.013			
7/5/2017 (Wed)	2.001	3.741	2.979			
7/6/2017 (Thu)	1.935	3.740	3.003			
7/7/2017 (Fri)	**1.506**	4.879	3.082			
7/8/2017 (Sat)	2.165	4.042	**3.169**			
7/9/2017 (Sun)	1.976	4.000	3.063			
7/10/2017 (Mon)	2.073	3.760	3.032			
7/11/2017 (Tue)	2.175	3.900	3.073			
7/12/2017 (Wed)	1.973	3.750	3.048			
7/13/2017 (Thu)	2.061	3.891	3.052			
7/14/2017 (Fri)	1.926	3.680	3.039			
7/15/2017 (Sat)	2.175	3.920	3.040			
7/16/2017 (Sun)	1.991	3.937	3.020			
7/17/2017 (Mon)	1.771	3.897	3.023			
7/18/2017 (Tue)	1.871	3.768	3.051			
7/19/2017 (Wed)	2.072	3.803	2.995			
7/20/2017 (Thu)	1.920	3.828	3.007			
7/21/2017 (Fri)	2.108	3.796	3.023			
7/22/2017 (Sat)	1.937	3.833	2.919			
7/23/2017 (Sun)	2.054	3.842	2.872			
7/24/2017 (Mon)	1.854	**4.934**	3.031			
7/25/2017 (Tue)	2.042	3.666	2.998			
7/26/2017 (Wed)	2.029	3.846	2.983			
7/27/2017 (Thu)	1.571	3.699	2.998			
7/28/2017 (Fri)	1.677	3.777	2.967			
7/29/2017 (Sat)	1.789	3.757	2.882			
7/30/2017 (Sun)	1.922	3.663	2.922			
7/31/2017 (Mon)	1.907	3.727	2.932			
		Total for period	92.939			
		Min:	1.506			
		Avg:	2.998			
		Max:	4.934			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place | Bergen County, NJ | 42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	1.959	3.558	2.904			
8/2/2017 (Wed)	1.616	4.257	2.982			
8/3/2017 (Thu)	2.247	3.870	3.057			
8/4/2017 (Fri)	2.117	3.874	3.047			
8/5/2017 (Sat)	2.075	3.852	2.987			
8/6/2017 (Sun)	1.966	3.803	2.966			
8/7/2017 (Mon)	2.039	3.956	2.978			
8/8/2017 (Tue)	2.126	3.848	3.077			
8/9/2017 (Wed)	1.991	3.698	3.017			
8/10/2017 (Thu)	2.042	3.725	2.987			
8/11/2017 (Fri)	1.947	3.708	2.981			
8/12/2017 (Sat)	2.116	3.707	3.015			
8/13/2017 (Sun)	1.784	3.825	2.939			
8/14/2017 (Mon)	1.795	3.746	2.987			
8/15/2017 (Tue)	1.659	4.040	2.991			
8/16/2017 (Wed)	1.857	3.700	2.977			
8/17/2017 (Thu)	1.819	3.815	2.955			
8/18/2017 (Fri)	**1.288**	**8.062**	**3.437**			
8/19/2017 (Sat)	2.178	4.078	3.120			
8/20/2017 (Sun)	2.069	3.901	3.115			
8/21/2017 (Mon)	1.776	3.953	3.074			
8/22/2017 (Tue)	2.031	3.788	3.071			
8/23/2017 (Wed)	2.034	4.101	3.066			
8/24/2017 (Thu)	1.960	3.833	2.999			
8/25/2017 (Fri)	2.055	3.833	2.974			
8/26/2017 (Sat)	1.939	3.667	2.882			
8/27/2017 (Sun)	1.859	3.690	2.899			
8/28/2017 (Mon)	1.781	3.636	2.923			
8/29/2017 (Tue)	1.939	3.666	2.932			
8/30/2017 (Wed)	1.929	3.631	2.915			
8/31/2017 (Thu)	1.829	3.824	2.931			
9/1/2017 (Fri)	1.931	3.853	2.916			
9/2/2017 (Sat)	1.867	3.633	2.781			
9/3/2017 (Sun)	1.869	3.977	2.943			
9/4/2017 (Mon)	1.927	3.883	2.969			
9/5/2017 (Tue)	1.796	4.315	3.005			
9/6/2017 (Wed)	1.956	3.818	2.987			
9/7/2017 (Thu)	2.068	3.730	3.070			
9/8/2017 (Fri)	1.929	3.878	2.990			
9/9/2017 (Sat)	2.046	3.875	2.948			
9/10/2017 (Sun)	1.729	3.749	2.963			
9/11/2017 (Mon)	1.823	3.794	2.952			
9/12/2017 (Tue)	1.783	3.801	2.960			
9/13/2017 (Wed)	1.773	3.815	1.481			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
4
Nordhoff Place

Bergen County, NJ

42" circular line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			130.169			
Min:			1.288			
Avg:			2.958			
Max:			8.062			

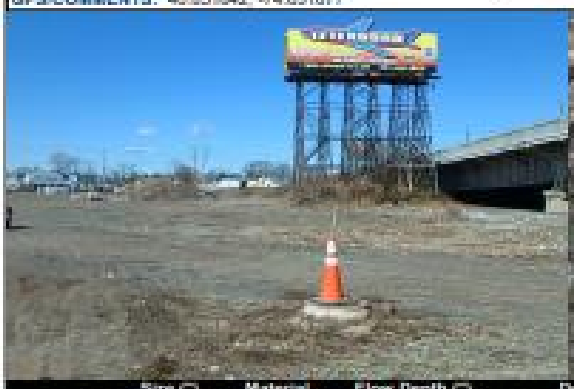
9.5 Meter Site No. 5

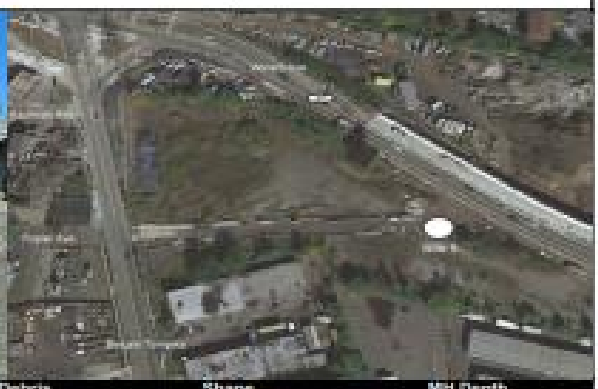
Flow metering was conducted on the lower end of the Main Trunk Sewer relatively near the WPCF. The meter was originally intended to be installed closer to the WPCF, however access issues resulted in the meter being moved further upstream. (See Plate 5)

FLOW ASSESSMENT SERVICES

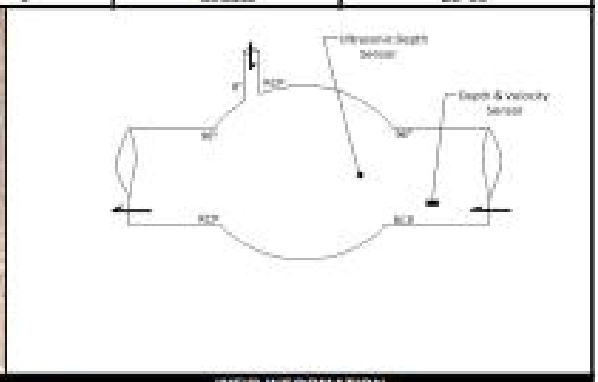
METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	DATE: March 8, 2017	JOB#: 16005
LOCATION: Bergen Turnpike R.O.W. and Route 46	MH#:	METER SITE: 5
GPS/COMMENTS: 40.851642, -74.031677		





	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	96	RCP	42	0	Circular	28' 00"
Incoming	8	RCP	0.5	0	Circular	N/A
Incoming						
Outgoing	96	RCP	42	0	Circular	28' 00"



SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 20' 00"	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

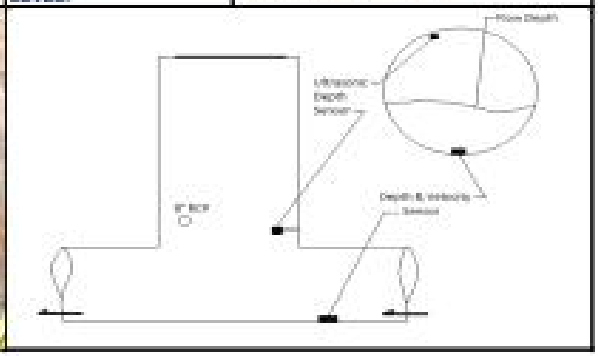


Plate 5

Table 9-6 Summary Flow Data Temp Meter Site 5

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
5
Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/8/2017 (Wed)	33.061	43.481	20.288			
3/9/2017 (Thu)	23.316	44.332	34.601			
3/10/2017 (Fri)	22.472	47.620	36.388			
3/11/2017 (Sat)	22.440	46.126	35.430			
3/12/2017 (Sun)	22.357	46.571	35.136			
3/13/2017 (Mon)	21.568	42.316	33.859			
3/14/2017 (Tue)	21.338	46.609	34.463			
3/15/2017 (Wed)	21.334	46.476	34.960			
3/16/2017 (Thu)	22.383	46.577	36.405			
3/17/2017 (Fri)	22.731	47.241	36.774			
3/18/2017 (Sat)	23.616	51.421	37.042			
3/19/2017 (Sun)	23.815	61.259	40.907			
3/20/2017 (Mon)	25.301	50.751	40.811			
3/21/2017 (Tue)	27.339	53.286	41.837			
3/22/2017 (Wed)	29.432	50.483	41.515			
3/23/2017 (Thu)	26.331	48.710	39.573			
3/24/2017 (Fri)	27.662	49.572	39.888			
3/25/2017 (Sat)	25.989	52.935	39.878			
3/26/2017 (Sun)	26.727	50.714	40.025			
3/27/2017 (Mon)	25.910	57.761	43.494			
3/28/2017 (Tue)	28.868	61.577	45.719			
3/29/2017 (Wed)	29.735	59.635	45.874			
3/30/2017 (Thu)	31.030	54.573	42.688			
3/31/2017 (Fri)	35.651	73.201	53.359			
		Total for period	929.906			
		Min:	21.334			
		Avg:	36.746			
		Max:	73.201			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
5
Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	47.653	72.424	59.168			
4/2/2017 (Sun)	33.191	63.740	51.815			
4/3/2017 (Mon)	36.081	63.115	49.081			
4/4/2017 (Tue)	44.868	80.256	**64.868**			
4/5/2017 (Wed)	47.275	69.844	58.428			
4/6/2017 (Thu)	42.057	**81.346**	60.151			
4/7/2017 (Fri)	48.969	74.329	60.815			
4/8/2017 (Sat)	40.941	67.564	54.208			
4/9/2017 (Sun)	34.036	62.576	50.267			
4/10/2017 (Mon)	33.735	58.710	48.850			
4/11/2017 (Tue)	32.293	55.111	46.106			
4/12/2017 (Wed)	30.454	59.342	44.368			
4/13/2017 (Thu)	28.250	52.276	42.178			
4/14/2017 (Fri)	26.856	54.103	41.391			
4/15/2017 (Sat)	27.515	53.993	41.053			
4/16/2017 (Sun)	27.312	54.826	41.004			
4/17/2017 (Mon)	26.534	49.299	39.840			
4/18/2017 (Tue)	25.662	48.124	38.656			
4/19/2017 (Wed)	24.378	48.244	37.820			
4/20/2017 (Thu)	24.622	46.284	38.247			
4/21/2017 (Fri)	28.630	51.229	41.196			
4/22/2017 (Sat)	24.450	52.527	38.616			
4/23/2017 (Sun)	25.240	48.203	38.004			
4/24/2017 (Mon)	**22.600**	45.981	36.934			
4/25/2017 (Tue)	23.080	62.088	40.119			
4/26/2017 (Wed)	35.318	59.954	46.790			
4/27/2017 (Thu)	28.239	52.739	41.872			
4/28/2017 (Fri)	26.719	50.887	40.193			
4/29/2017 (Sat)	25.011	50.824	39.065			
4/30/2017 (Sun)	23.817	53.038	38.211			
		Total for period	1,369.252			
		Min:	22.600			
		Avg:	45.642			
		Max:	81.346			

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Summary Flow Report

Site:
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Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	24.498	46.978	37.471			
5/2/2017 (Tue)	25.160	48.620	37.386			
5/3/2017 (Wed)	23.961	45.959	36.159			
5/4/2017 (Thu)	**21.928**	44.857	35.271			
5/5/2017 (Fri)	23.197	80.918	48.262			
5/6/2017 (Sat)	40.218	**96.934**	**59.688**			
5/7/2017 (Sun)	36.087	66.783	52.866			
5/8/2017 (Mon)	33.087	58.963	47.857			
5/9/2017 (Tue)	31.041	57.755	45.639			
5/10/2017 (Wed)	28.226	53.091	44.293			
5/11/2017 (Thu)	28.832	52.403	42.570			
5/12/2017 (Fri)	27.598	51.711	41.165			
5/13/2017 (Sat)	27.363	72.566	48.997			
5/14/2017 (Sun)	43.523	70.648	56.342			
5/15/2017 (Mon)	34.053	58.400	49.243			
5/16/2017 (Tue)	33.496	55.630	46.455			
5/17/2017 (Wed)	30.446	54.672	44.759			
5/18/2017 (Thu)	29.069	55.065	43.844			
5/19/2017 (Fri)	29.345	52.986	42.600			
5/20/2017 (Sat)	26.582	52.079	39.904			
5/21/2017 (Sun)	25.902	50.572	39.308			
5/22/2017 (Mon)	25.665	53.179	42.059			
5/23/2017 (Tue)	27.275	50.648	40.230			
5/24/2017 (Wed)	25.742	48.973	38.998			
5/25/2017 (Thu)	24.237	55.606	41.965			
5/26/2017 (Fri)	30.855	54.308	43.731			
5/27/2017 (Sat)	23.635	48.137	38.313			
5/28/2017 (Sun)	24.988	50.781	36.625			
5/29/2017 (Mon)	22.264	53.029	37.493			
5/30/2017 (Tue)	23.374	47.756	36.555			
5/31/2017 (Wed)	25.264	47.315	36.809			
		Total for period	1,332.687			
		Min:	21.928			
		Avg:	42.960			
		Max:	96.934			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	24.002	47.368	36.496			
6/2/2017 (Fri)	22.712	44.033	34.965			
6/3/2017 (Sat)	22.101	46.202	34.810			
6/4/2017 (Sun)	21.724	47.678	34.824			
6/5/2017 (Mon)	21.569	44.173	34.973			
6/6/2017 (Tue)	20.751	45.770	35.276			
6/7/2017 (Wed)	22.085	44.660	34.360			
6/8/2017 (Thu)	20.954	43.576	33.927			
6/9/2017 (Fri)	21.237	41.919	33.887			
6/10/2017 (Sat)	19.773	47.309	33.055			
6/11/2017 (Sun)	19.315	44.206	33.153			
6/12/2017 (Mon)	20.139	43.160	33.330			
6/13/2017 (Tue)	20.137	41.920	32.984			
6/14/2017 (Wed)	21.716	39.886	32.401			
6/15/2017 (Thu)	19.498	39.338	31.939			
6/16/2017 (Fri)	19.546	46.775	32.625			
6/17/2017 (Sat)	19.791	**52.409**	34.369			
6/18/2017 (Sun)	18.465	45.780	32.035			
6/19/2017 (Mon)	20.196	50.343	34.728			
6/20/2017 (Tue)	22.314	42.355	33.302			
6/21/2017 (Wed)	20.604	42.112	32.987			
6/22/2017 (Thu)	19.777	42.114	32.160			
6/23/2017 (Fri)	19.714	41.350	32.140			
6/24/2017 (Sat)	26.153	52.200	**37.825**			
6/25/2017 (Sun)	18.650	43.274	32.013			
6/26/2017 (Mon)	18.714	45.724	32.146			
6/27/2017 (Tue)	20.265	48.642	32.618			
6/28/2017 (Wed)	18.748	39.921	30.471			
6/29/2017 (Thu)	**17.492**	41.724	30.454			
6/30/2017 (Fri)	19.052	39.070	30.205			
		Total for period	1,000.460			
		Min:	17.492			
		Avg:	33.349			
		Max:	52.409			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	17.471	46.864	31.484			
7/2/2017 (Sun)	18.146	37.673	29.157			
7/3/2017 (Mon)	18.226	41.018	29.296			
7/4/2017 (Tue)	18.654	43.318	31.160			
7/5/2017 (Wed)	18.136	37.474	29.509			
7/6/2017 (Thu)	18.053	39.217	29.591			
7/7/2017 (Fri)	17.705	**59.450**	**37.658**			
7/8/2017 (Sat)	21.934	48.525	35.933			
7/9/2017 (Sun)	20.386	41.429	31.920			
7/10/2017 (Mon)	19.924	42.612	32.975			
7/11/2017 (Tue)	22.279	44.613	32.981			
7/12/2017 (Wed)	20.336	43.704	31.607			
7/13/2017 (Thu)	18.823	39.161	31.026			
7/14/2017 (Fri)	17.758	50.515	35.924			
7/15/2017 (Sat)	21.680	45.780	32.747			
7/16/2017 (Sun)	18.162	43.663	31.501			
7/17/2017 (Mon)	19.698	40.174	30.938			
7/18/2017 (Tue)	18.395	39.896	30.774			
7/19/2017 (Wed)	18.387	40.230	30.604			
7/20/2017 (Thu)	18.376	38.712	30.453			
7/21/2017 (Fri)	18.432	37.702	30.187			
7/22/2017 (Sat)	17.456	39.791	29.679			
7/23/2017 (Sun)	18.437	39.663	31.103			
7/24/2017 (Mon)	18.790	56.420	37.031			
7/25/2017 (Tue)	20.426	41.847	31.792			
7/26/2017 (Wed)	18.650	40.796	30.945			
7/27/2017 (Thu)	19.125	40.363	30.906			
7/28/2017 (Fri)	18.113	39.503	30.588			
7/29/2017 (Sat)	16.609	40.167	29.343			
7/30/2017 (Sun)	**15.752**	38.983	28.759			
7/31/2017 (Mon)	18.016	37.152	28.816			
		Total for period	976.390			
		Min:	15.752			
		Avg:	31.496			
		Max:	59.450			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	17.654	35.146	28.506			
8/2/2017 (Wed)	17.451	45.378	30.487			
8/3/2017 (Thu)	17.738	35.814	28.743			
8/4/2017 (Fri)	17.413	38.916	29.173			
8/5/2017 (Sat)	18.305	41.852	30.660			
8/6/2017 (Sun)	15.809	36.905	27.786			
8/7/2017 (Mon)	17.629	**50.611**	33.079			
8/8/2017 (Tue)	18.513	39.776	30.153			
8/9/2017 (Wed)	17.107	38.796	29.332			
8/10/2017 (Thu)	17.243	37.621	28.949			
8/11/2017 (Fri)	16.962	37.403	28.746			
8/12/2017 (Sat)	18.425	42.253	30.342			
8/13/2017 (Sun)	15.868	39.322	28.369			
8/14/2017 (Mon)	17.534	37.540	28.668			
8/15/2017 (Tue)	17.960	36.680	29.189			
8/16/2017 (Wed)	17.461	36.796	28.559			
8/17/2017 (Thu)	17.795	35.392	28.214			
8/18/2017 (Fri)	17.430	49.164	**35.671**			
8/19/2017 (Sat)	20.416	41.414	31.402			
8/20/2017 (Sun)	17.213	38.332	28.843			
8/21/2017 (Mon)	17.573	37.984	29.333			
8/22/2017 (Tue)	17.601	38.839	29.553			
8/23/2017 (Wed)	18.658	40.747	30.470			
8/24/2017 (Thu)	17.175	37.840	28.023			
8/25/2017 (Fri)	16.058	38.684	27.980			
8/26/2017 (Sat)	15.621	40.114	27.200			
8/27/2017 (Sun)	15.966	37.617	26.955			
8/28/2017 (Mon)	16.197	37.131	27.605			
8/29/2017 (Tue)	16.469	35.260	27.683			
8/30/2017 (Wed)	15.789	35.293	27.855			
8/31/2017 (Thu)	16.202	35.169	27.009			
9/1/2017 (Fri)	15.995	34.283	26.562			
9/2/2017 (Sat)	**13.614**	40.121	26.721			
9/3/2017 (Sun)	22.990	45.411	33.276			
9/4/2017 (Mon)	16.284	42.728	28.506			
9/5/2017 (Tue)	17.144	44.204	29.769			
9/6/2017 (Wed)	17.618	45.754	32.377			
9/7/2017 (Thu)	26.466	42.840	33.811			
9/8/2017 (Fri)	23.639	36.943	31.413			
9/9/2017 (Sat)	22.372	39.581	31.205			
9/10/2017 (Sun)	21.870	41.172	31.489			
9/11/2017 (Mon)	22.185	38.909	31.150			
9/12/2017 (Tue)	22.356	34.907	30.521			
9/13/2017 (Wed)	22.369	35.426	17.157			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Bergen Turnpike R.O.W. and Route 46 Bergen County, NJ 96" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			1,288.514			
Min:			13.614			
Avg:			29.284			
Max:			50.611			

9.6 Meter Site No. 6

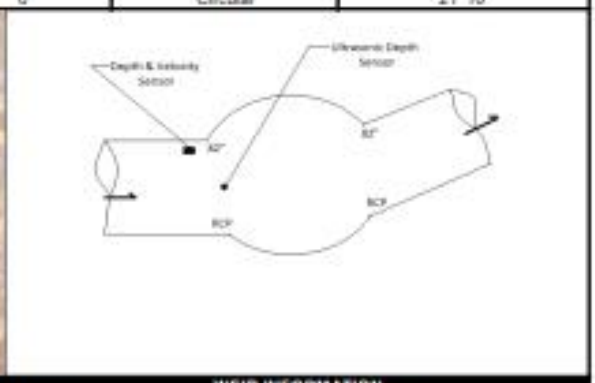
Flow metering was conducted on the upper end of the Main Trunk Sewer in New Milford as an upper boundary condition to the model. The proposed meter location was moved into New Milford due to access problems. (See Plate 6)

FLOW
ASSESSMENT SERVICES

METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	DATE: March 9, 2017	JOB#: 16095
LOCATION: 151 River Lane	MH#:	METER SITE: 6
GPS/COMMENTS: 40.920453, -74.030131		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	82	RCP	30	0	Circular	21' 10"
Incoming						
Incoming						
Outgoing	82	RCP	30	0	Circular	21' 10"



SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

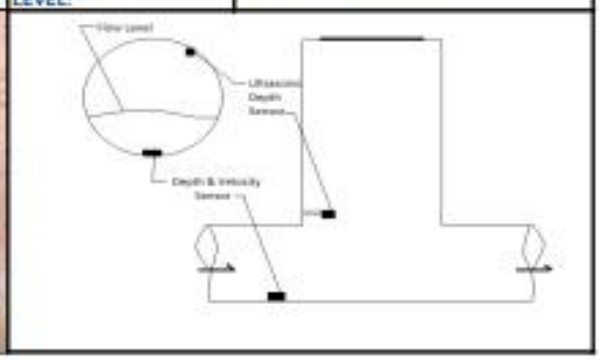


Plate 6

Table 9-7 Summary Flow Data Temp Meter Site 6

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
6
151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/9/2017 (Thu)	19.060	25.503	6.733			
3/10/2017 (Fri)	**11.349**	26.473	20.550			
3/11/2017 (Sat)	12.340	27.901	20.651			
3/12/2017 (Sun)	12.985	27.716	20.678			
3/13/2017 (Mon)	11.623	24.434	19.456			
3/14/2017 (Tue)	12.182	26.791	19.886			
3/15/2017 (Wed)	11.896	26.274	20.107			
3/16/2017 (Thu)	12.024	26.014	19.960			
3/17/2017 (Fri)	12.565	24.359	18.910			
3/18/2017 (Sat)	11.725	28.903	20.587			
3/19/2017 (Sun)	12.932	30.035	22.002			
3/20/2017 (Mon)	14.723	26.918	21.614			
3/21/2017 (Tue)	14.696	28.928	21.965			
3/22/2017 (Wed)	15.922	28.031	22.637			
3/23/2017 (Thu)	13.774	27.099	21.885			
3/24/2017 (Fri)	13.146	27.774	21.749			
3/25/2017 (Sat)	14.625	29.588	22.304			
3/26/2017 (Sun)	15.034	29.383	22.908			
3/27/2017 (Mon)	14.173	30.034	23.527			
3/28/2017 (Tue)	15.434	30.913	24.316			
3/29/2017 (Wed)	15.361	30.319	24.453			
3/30/2017 (Thu)	16.183	29.600	23.284			
3/31/2017 (Fri)	16.069	**36.203**	**26.334**			
		Total for period	467.496			
		Min:	11.349			
		Avg:	21.195			
		Max:	36.203			

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Summary Flow Report

Site:
6
151 River Lane | Bergen County, NJ | 82" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	22.430	37.639	29.987			
4/2/2017 (Sun)	18.817	35.920	27.884			
4/3/2017 (Mon)	18.298	32.273	26.690			
4/4/2017 (Tue)	21.710	41.626	**33.596**			
4/5/2017 (Wed)	24.217	39.233	31.895			
4/6/2017 (Thu)	21.787	**43.318**	31.819			
4/7/2017 (Fri)	24.822	39.653	32.175			
4/8/2017 (Sat)	21.375	38.216	30.067			
4/9/2017 (Sun)	19.428	36.856	28.229			
4/10/2017 (Mon)	19.226	33.897	27.809			
4/11/2017 (Tue)	18.062	32.410	25.596			
4/12/2017 (Wed)	17.096	33.226	24.826			
4/13/2017 (Thu)	16.342	26.858	23.882			
4/14/2017 (Fri)	15.698	29.817	23.467			
4/15/2017 (Sat)	15.771	31.244	23.794			
4/16/2017 (Sun)	15.368	33.305	23.733			
4/17/2017 (Mon)	15.457	27.946	22.577			
4/18/2017 (Tue)	14.207	27.702	21.803			
4/19/2017 (Wed)	13.436	27.173	21.616			
4/20/2017 (Thu)	13.890	27.084	21.574			
4/21/2017 (Fri)	15.090	28.686	22.175			
4/22/2017 (Sat)	14.028	27.741	21.842			
4/23/2017 (Sun)	13.650	28.371	21.848			
4/24/2017 (Mon)	13.698	26.359	21.067			
4/25/2017 (Tue)	**13.423**	30.844	22.017			
4/26/2017 (Wed)	16.697	28.796	23.676			
4/27/2017 (Thu)	15.265	28.472	22.675			
4/28/2017 (Fri)	14.970	28.257	22.158			
4/29/2017 (Sat)	14.906	29.722	22.193			
4/30/2017 (Sun)	14.009	28.429	21.917			
		Total for period	754.972			
		Min:	13.423			
		Avg:	25.166			
		Max:	43.318			

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Summary Flow Report

Site:
6
151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	13.694	26.912	21.245			
5/2/2017 (Tue)	13.505	26.298	20.953			
5/3/2017 (Wed)	13.301	25.500	20.162			
5/4/2017 (Thu)	**12.505**	24.960	19.944			
5/5/2017 (Fri)	12.913	**43.592**	25.270			
5/6/2017 (Sat)	20.135	39.725	29.052			
5/7/2017 (Sun)	19.501	34.378	28.314			
5/8/2017 (Mon)	18.870	32.046	26.196			
5/9/2017 (Tue)	17.242	31.098	24.871			
5/10/2017 (Wed)	16.487	30.288	24.274			
5/11/2017 (Thu)	16.028	28.851	23.668			
5/12/2017 (Fri)	15.721	28.994	23.034			
5/13/2017 (Sat)	14.924	36.058	26.242			
5/14/2017 (Sun)	22.032	36.960	**29.847**			
5/15/2017 (Mon)	19.264	33.202	27.083			
5/16/2017 (Tue)	17.989	32.156	25.396			
5/17/2017 (Wed)	17.640	29.854	24.682			
5/18/2017 (Thu)	16.423	29.673	24.082			
5/19/2017 (Fri)	15.881	28.736	23.226			
5/20/2017 (Sat)	14.546	29.657	22.427			
5/21/2017 (Sun)	14.230	29.194	22.432			
5/22/2017 (Mon)	13.880	27.858	22.387			
5/23/2017 (Tue)	14.617	27.468	22.030			
5/24/2017 (Wed)	14.033	26.191	21.384			
5/25/2017 (Thu)	13.663	26.959	21.715			
5/26/2017 (Fri)	15.020	28.623	22.302			
5/27/2017 (Sat)	13.615	26.347	20.907			
5/28/2017 (Sun)	13.450	27.847	20.442			
5/29/2017 (Mon)	12.676	26.335	21.023			
5/30/2017 (Tue)	12.968	25.921	20.613			
5/31/2017 (Wed)	12.724	25.820	20.526			
		Total for period	725.689			
		Min:	12.505			
		Avg:	23.409			
		Max:	43.592			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	13.162	25.974	**20.307**			
6/2/2017 (Fri)	12.566	25.237	19.935			
6/3/2017 (Sat)	12.196	26.065	19.524			
6/4/2017 (Sun)	11.857	**26.317**	19.858			
6/5/2017 (Mon)	12.276	24.464	19.411			
6/6/2017 (Tue)	12.279	24.646	19.441			
6/7/2017 (Wed)	11.643	24.282	19.028			
6/8/2017 (Thu)	11.425	23.542	18.642			
6/9/2017 (Fri)	11.651	23.733	18.428			
6/10/2017 (Sat)	11.065	24.126	18.138			
6/11/2017 (Sun)	10.358	24.793	18.414			
6/12/2017 (Mon)	10.502	22.551	17.773			
6/13/2017 (Tue)	10.462	22.437	17.590			
6/14/2017 (Wed)	10.731	22.191	17.462			
6/15/2017 (Thu)	10.518	21.824	17.337			
6/16/2017 (Fri)	10.261	22.312	17.331			
6/17/2017 (Sat)	10.169	25.171	17.819			
6/18/2017 (Sun)	10.317	24.470	18.201			
6/19/2017 (Mon)	10.263	23.838	18.255			
6/20/2017 (Tue)	10.931	22.565	17.769			
6/21/2017 (Wed)	10.543	21.957	17.377			
6/22/2017 (Thu)	10.021	21.554	17.164			
6/23/2017 (Fri)	10.093	21.332	17.165			
6/24/2017 (Sat)	11.500	26.297	18.223			
6/25/2017 (Sun)	9.946	23.011	17.275			
6/26/2017 (Mon)	9.841	21.112	16.732			
6/27/2017 (Tue)	10.137	21.252	16.672			
6/28/2017 (Wed)	9.794	25.429	16.341			
6/29/2017 (Thu)	**8.986**	21.291	16.255			
6/30/2017 (Fri)	9.403	20.502	16.186			
		Total for period	540.253			
		Min:	8.986			
		Avg:	18.008			
		Max:	26.317			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	9.357	22.747	16.297			
7/2/2017 (Sun)	9.173	21.130	15.733			
7/3/2017 (Mon)	9.349	20.576	15.460			
7/4/2017 (Tue)	9.111	21.191	15.665			
7/5/2017 (Wed)	9.073	20.013	15.621			
7/6/2017 (Thu)	9.349	20.097	15.523			
7/7/2017 (Fri)	9.251	**31.117**	16.696			
7/8/2017 (Sat)	11.784	25.322	**18.724**			
7/9/2017 (Sun)	10.340	23.344	17.306			
7/10/2017 (Mon)	10.486	20.818	16.947			
7/11/2017 (Tue)	10.549	21.576	16.967			
7/12/2017 (Wed)	9.902	21.035	16.704			
7/13/2017 (Thu)	9.733	21.088	16.451			
7/14/2017 (Fri)	9.687	23.908	17.394			
7/15/2017 (Sat)	10.634	23.361	17.181			
7/16/2017 (Sun)	9.696	22.886	16.858			
7/17/2017 (Mon)	10.002	21.529	16.627			
7/18/2017 (Tue)	9.782	20.606	16.469			
7/19/2017 (Wed)	9.569	20.501	16.316			
7/20/2017 (Thu)	9.741	20.987	16.335			
7/21/2017 (Fri)	9.705	21.198	16.332			
7/22/2017 (Sat)	9.256	21.501	16.053			
7/23/2017 (Sun)	9.166	21.928	16.258			
7/24/2017 (Mon)	9.267	25.356	17.546			
7/25/2017 (Tue)	10.079	19.715	16.503			
7/26/2017 (Wed)	9.750	19.638	16.251			
7/27/2017 (Thu)	9.838	19.539	16.243			
7/28/2017 (Fri)	9.874	19.973	16.244			
7/29/2017 (Sat)	9.226	21.451	15.526			
7/30/2017 (Sun)	8.877	21.381	15.402			
7/31/2017 (Mon)	**8.854**	19.512	15.073			
		Total for period	510.723			
		Min:	8.854			
		Avg:	16.475			
		Max:	31.117			

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Summary Flow Report

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Site:
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151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	8.508	19.199	14.889			
8/2/2017 (Wed)	8.160	**23.336**	14.939			
8/3/2017 (Thu)	8.698	18.679	14.614			
8/4/2017 (Fri)	8.488	18.512	14.429			
8/5/2017 (Sat)	8.471	21.021	15.047			
8/6/2017 (Sun)	8.357	20.459	14.681			
8/7/2017 (Mon)	8.205	20.477	15.338			
8/8/2017 (Tue)	9.148	18.944	14.992			
8/9/2017 (Wed)	8.393	18.514	14.567			
8/10/2017 (Thu)	8.508	18.287	14.085			
8/11/2017 (Fri)	7.721	17.565	13.650			
8/12/2017 (Sat)	8.635	19.629	14.299			
8/13/2017 (Sun)	8.140	21.510	14.619			
8/14/2017 (Mon)	8.105	18.686	15.058			
8/15/2017 (Tue)	8.956	18.525	15.135			
8/16/2017 (Wed)	8.849	18.839	15.162			
8/17/2017 (Thu)	8.701	18.545	14.967			
8/18/2017 (Fri)	8.616	21.232	**16.291**			
8/19/2017 (Sat)	9.242	20.774	15.660			
8/20/2017 (Sun)	8.538	19.933	15.304			
8/21/2017 (Mon)	8.783	18.745	15.281			
8/22/2017 (Tue)	8.831	18.693	15.264			
8/23/2017 (Wed)	9.259	18.749	15.270			
8/24/2017 (Thu)	8.457	18.693	14.877			
8/25/2017 (Fri)	8.353	18.583	14.783			
8/26/2017 (Sat)	8.061	19.672	14.615			
8/27/2017 (Sun)	7.867	19.333	14.570			
8/28/2017 (Mon)	8.258	18.256	14.539			
8/29/2017 (Tue)	8.003	17.992	14.453			
8/30/2017 (Wed)	8.171	18.252	14.603			
8/31/2017 (Thu)	8.040	18.042	14.334			
9/1/2017 (Fri)	7.828	18.446	14.235			
9/2/2017 (Sat)	**7.505**	18.355	13.857			
9/3/2017 (Sun)	9.553	21.674	15.676			
9/4/2017 (Mon)	8.058	20.935	15.326			
9/5/2017 (Tue)	8.224	19.665	15.126			
9/6/2017 (Wed)	8.219	20.427	15.647			
9/7/2017 (Thu)	9.876	19.479	16.015			
9/8/2017 (Fri)	8.647	18.937	15.077			
9/9/2017 (Sat)	7.959	20.875	15.114			
9/10/2017 (Sun)	7.720	20.717	15.307			
9/11/2017 (Mon)	7.998	18.899	15.026			
9/12/2017 (Tue)	7.896	18.872	14.727			
9/13/2017 (Wed)	7.958	18.310	7.296			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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151 River Lane | Bergen County, NJ | 82" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			648.785			
Min:			7.505			
Avg:			14.745			
Max:			23.336			

9.7 Meter Site No. 7

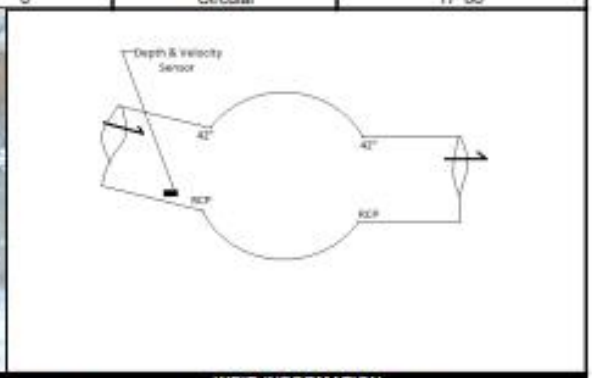
Flow metering was conducted on the lower end of the Paramus, Maywood, River Edge Branch Trunk Sewer just upstream of the Main Trunk Sewer in Hackensack as another upper boundary condition to the model. (See Plate 7)

FLOW
ASSESSMENT SERVICES

METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	**DATE:** March 9, 2017	**JOB#:** 16095
LOCATION: Hackensack Avenue Shopping Mall	**MH#:**	**METER SITE:** 7
GPS/COMMENTS: 40.910323, -74.030191		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	42	RCP	18	0	Circular	17' 04"
Incoming						
Incoming						
Outgoing	42	RCP	18	0	Circular	17' 06"



SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT:	**LENGTH:**	**HEIGHT ABOVE WEIR:**
SURCHARGED MARKS TO: 15'	**BREADTH:**	**OVERFLOW OCCURS AT:**
SURCHARGE CURRENTLY TO:	**LEVEL:**	

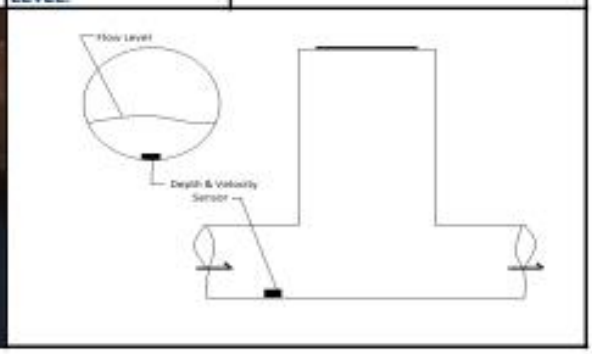


Plate 7

Table 9-8 Summary Flow Data Temp Meter Site 7

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
7
Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/9/2017 (Thu)	6.236	7.781	2.841			
3/10/2017 (Fri)	3.734	8.218	6.478			
3/11/2017 (Sat)	3.767	8.906	6.569			
3/12/2017 (Sun)	3.662	8.451	6.250			
3/13/2017 (Mon)	3.538	7.633	6.135			
3/14/2017 (Tue)	3.661	7.686	5.967			
3/15/2017 (Wed)	3.715	8.093	6.361			
3/16/2017 (Thu)	**3.516**	8.060	6.317			
3/17/2017 (Fri)	3.568	8.142	6.444			
3/18/2017 (Sat)	3.903	8.900	6.653			
3/19/2017 (Sun)	3.890	9.299	6.690			
3/20/2017 (Mon)	4.283	9.102	7.228			
3/21/2017 (Tue)	4.689	10.348	7.633			
3/22/2017 (Wed)	5.057	9.254	7.746			
3/23/2017 (Thu)	4.777	9.146	7.432			
3/24/2017 (Fri)	4.628	8.929	7.317			
3/25/2017 (Sat)	4.686	9.860	7.358			
3/26/2017 (Sun)	4.481	9.312	7.111			
3/27/2017 (Mon)	4.782	10.098	7.671			
3/28/2017 (Tue)	5.052	10.197	7.862			
3/29/2017 (Wed)	5.436	9.941	8.059			
3/30/2017 (Thu)	5.110	9.460	7.729			
3/31/2017 (Fri)	5.370	**12.988**	**9.377**			
		Total for period	159.418			
		Min:	3.516			
		Avg:	6.931			
		Max:	12.988			

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Summary Flow Report

Site:
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Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	8.601	12.498	10.791			
4/2/2017 (Sun)	7.011	11.360	9.492			
4/3/2017 (Mon)	6.637	10.234	9.036			
4/4/2017 (Tue)	7.471	13.810	**12.038**			
4/5/2017 (Wed)	8.714	11.918	10.860			
4/6/2017 (Thu)	7.909	**14.497**	11.147			
4/7/2017 (Fri)	9.462	12.733	11.437			
4/8/2017 (Sat)	7.966	12.486	10.510			
4/9/2017 (Sun)	7.075	11.736	9.661			
4/10/2017 (Mon)	6.911	10.973	9.451			
4/11/2017 (Tue)	6.669	10.638	9.196			
4/12/2017 (Wed)	6.419	10.450	8.993			
4/13/2017 (Thu)	6.129	10.265	8.776			
4/14/2017 (Fri)	5.800	10.273	8.571			
4/15/2017 (Sat)	5.676	10.582	8.604			
4/16/2017 (Sun)	5.694	10.446	8.271			
4/17/2017 (Mon)	5.470	9.610	8.230			
4/18/2017 (Tue)	5.073	9.262	7.901			
4/19/2017 (Wed)	5.135	9.066	7.807			
4/20/2017 (Thu)	4.954	9.273	7.824			
4/21/2017 (Fri)	5.357	9.607	8.107			
4/22/2017 (Sat)	5.178	9.816	7.912			
4/23/2017 (Sun)	5.025	9.655	7.722			
4/24/2017 (Mon)	**4.821**	9.748	7.639			
4/25/2017 (Tue)	4.840	11.532	7.781			
4/26/2017 (Wed)	5.778	10.221	8.543			
4/27/2017 (Thu)	5.572	9.596	8.122			
4/28/2017 (Fri)	5.440	9.475	7.910			
4/29/2017 (Sat)	5.134	10.277	7.814			
4/30/2017 (Sun)	4.932	9.478	7.415			
		Total for period	287.552			
		Min:	4.821			
		Avg:	8.918			
		Max:	14.497			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	4.944	9.294	7.527			
5/2/2017 (Tue)	4.920	9.573	7.507			
5/3/2017 (Wed)	4.691	8.747	7.255			
5/4/2017 (Thu)	4.583	8.743	7.097			
5/5/2017 (Fri)	**4.517**	**21.541**	10.846			
5/6/2017 (Sat)	9.016	14.614	**11.581**			
5/7/2017 (Sun)	8.102	12.999	10.608			
5/8/2017 (Mon)	7.185	11.649	9.918			
5/9/2017 (Tue)	6.941	10.832	9.625			
5/10/2017 (Wed)	6.537	11.154	9.383			
5/11/2017 (Thu)	6.187	10.304	8.986			
5/12/2017 (Fri)	6.025	10.312	8.776			
5/13/2017 (Sat)	5.815	13.334	10.182			
5/14/2017 (Sun)	8.675	13.128	11.183			
5/15/2017 (Mon)	7.866	11.632	10.192			
5/16/2017 (Tue)	6.934	10.749	9.485			
5/17/2017 (Wed)	6.468	10.435	9.184			
5/18/2017 (Thu)	6.241	10.132	8.881			
5/19/2017 (Fri)	5.934	9.949	8.696			
5/20/2017 (Sat)	5.764	10.207	8.388			
5/21/2017 (Sun)	5.551	9.912	8.105			
5/22/2017 (Mon)	5.482	10.049	8.413			
5/23/2017 (Tue)	5.612	9.574	8.293			
5/24/2017 (Wed)	5.342	9.231	8.049			
5/25/2017 (Thu)	5.106	9.768	8.239			
5/26/2017 (Fri)	6.157	10.029	8.633			
5/27/2017 (Sat)	5.477	9.975	8.067			
5/28/2017 (Sun)	5.178	9.432	7.547			
5/29/2017 (Mon)	5.061	10.161	7.831			
5/30/2017 (Tue)	4.993	9.172	7.802			
5/31/2017 (Wed)	5.091	9.216	7.844			
		Total for period	274.136			
		Min:	4.517			
		Avg:	8.843			
		Max:	21.541			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
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Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	5.262	**10.327**	**7.696**			
6/2/2017 (Fri)	5.035	9.089	7.348			
6/3/2017 (Sat)	4.917	9.782	7.265			
6/4/2017 (Sun)	4.731	9.091	7.041			
6/5/2017 (Mon)	4.889	8.784	7.197			
6/6/2017 (Tue)	4.619	8.877	7.150			
6/7/2017 (Wed)	4.777	8.892	7.220			
6/8/2017 (Thu)	4.362	8.693	7.170			
6/9/2017 (Fri)	4.589	8.653	7.044			
6/10/2017 (Sat)	4.607	9.531	7.018			
6/11/2017 (Sun)	4.603	8.674	6.755			
6/12/2017 (Mon)	4.368	8.553	6.889			
6/13/2017 (Tue)	4.561	8.674	7.001			
6/14/2017 (Wed)	4.433	8.390	6.840			
6/15/2017 (Thu)	4.517	8.636	6.818			
6/16/2017 (Fri)	4.209	8.838	6.761			
6/17/2017 (Sat)	4.453	9.620	7.034			
6/18/2017 (Sun)	4.291	8.883	6.727			
6/19/2017 (Mon)	4.422	8.924	7.030			
6/20/2017 (Tue)	4.596	8.910	7.224			
6/21/2017 (Wed)	4.401	8.566	6.969			
6/22/2017 (Thu)	4.338	8.602	6.784			
6/23/2017 (Fri)	4.214	8.402	6.685			
6/24/2017 (Sat)	4.784	9.511	7.159			
6/25/2017 (Sun)	4.251	8.334	6.401			
6/26/2017 (Mon)	4.261	7.651	6.289			
6/27/2017 (Tue)	4.005	7.571	6.212			
6/28/2017 (Wed)	**3.772**	7.446	6.110			
6/29/2017 (Thu)	3.861	8.337	6.315			
6/30/2017 (Fri)	3.883	8.084	6.321			
		Total for period	206.470			
		Min:	3.772			
		Avg:	6.882			
		Max:	10.327			

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FLOW ASSESSMENT SERVICES

Site:
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Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	3.832	8.968	6.389			
7/2/2017 (Sun)	4.052	7.867	6.072			
7/3/2017 (Mon)	3.970	8.406	6.276			
7/4/2017 (Tue)	4.307	8.427	6.344			
7/5/2017 (Wed)	3.977	7.614	6.180			
7/6/2017 (Thu)	3.847	7.624	6.159			
7/7/2017 (Fri)	3.896	**12.383**	7.319			
7/8/2017 (Sat)	4.768	8.964	7.004			
7/9/2017 (Sun)	4.330	8.136	6.423			
7/10/2017 (Mon)	4.330	8.462	6.618			
7/11/2017 (Tue)	4.575	8.203	6.656			
7/12/2017 (Wed)	4.139	8.255	6.577			
7/13/2017 (Thu)	4.012	7.824	6.305			
7/14/2017 (Fri)	3.960	9.326	6.669			
7/15/2017 (Sat)	4.756	8.921	7.019			
7/16/2017 (Sun)	4.079	8.372	6.568			
7/17/2017 (Mon)	3.981	8.274	6.714			
7/18/2017 (Tue)	4.152	8.089	6.722			
7/19/2017 (Wed)	4.000	8.214	6.668			
7/20/2017 (Thu)	3.852	8.026	6.587			
7/21/2017 (Fri)	3.808	8.140	6.533			
7/22/2017 (Sat)	3.669	8.161	6.436			
7/23/2017 (Sun)	3.990	8.170	6.514			
7/24/2017 (Mon)	3.612	11.176	**7.342**			
7/25/2017 (Tue)	4.202	8.343	6.825			
7/26/2017 (Wed)	3.966	8.280	6.718			
7/27/2017 (Thu)	3.663	7.961	6.608			
7/28/2017 (Fri)	4.331	8.475	6.669			
7/29/2017 (Sat)	3.841	8.283	6.374			
7/30/2017 (Sun)	3.591	7.612	6.021			
7/31/2017 (Mon)	**3.440**	7.658	6.194			
		Total for period	203.523			
		Min:	3.440			
		Avg:	6.565			
		Max:	12.383			

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FLOW ASSESSMENT SERVICES

Site:
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Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	3.577	7.693	6.195			
8/2/2017 (Wed)	3.389	8.021	6.287			
8/3/2017 (Thu)	3.450	7.470	6.095			
8/4/2017 (Fri)	3.324	7.682	6.093			
8/5/2017 (Sat)	3.365	8.238	6.349			
8/6/2017 (Sun)	3.395	7.610	5.928			
8/7/2017 (Mon)	3.546	9.095	6.638			
8/8/2017 (Tue)	3.973	7.933	6.404			
8/9/2017 (Wed)	3.481	8.080	6.196			
8/10/2017 (Thu)	3.268	7.689	6.082			
8/11/2017 (Fri)	3.428	7.598	6.068			
8/12/2017 (Sat)	3.659	8.454	6.366			
8/13/2017 (Sun)	3.407	7.699	5.951			
8/14/2017 (Mon)	3.530	7.911	6.132			
8/15/2017 (Tue)	3.721	8.006	6.267			
8/16/2017 (Wed)	3.726	7.958	6.316			
8/17/2017 (Thu)	3.638	7.682	6.097			
8/18/2017 (Fri)	3.578	10.226	**6.898**			
8/19/2017 (Sat)	4.126	8.404	6.477			
8/20/2017 (Sun)	3.579	7.623	6.062			
8/21/2017 (Mon)	3.645	7.575	6.149			
8/22/2017 (Tue)	3.496	7.623	6.152			
8/23/2017 (Wed)	3.832	7.532	6.233			
8/24/2017 (Thu)	3.380	7.777	6.067			
8/25/2017 (Fri)	3.179	7.906	6.020			
8/26/2017 (Sat)	3.041	7.980	5.982			
8/27/2017 (Sun)	3.069	7.714	5.713			
8/28/2017 (Mon)	3.042	7.639	5.887			
8/29/2017 (Tue)	3.139	7.436	5.870			
8/30/2017 (Wed)	3.020	7.484	5.920			
8/31/2017 (Thu)	3.038	7.759	5.837			
9/1/2017 (Fri)	2.980	7.707	5.775			
9/2/2017 (Sat)	3.005	7.740	5.780			
9/3/2017 (Sun)	3.387	8.264	5.978			
9/4/2017 (Mon)	3.106	8.244	6.044			
9/5/2017 (Tue)	2.942	8.026	5.987			
9/6/2017 (Wed)	3.013	8.127	6.197			
9/7/2017 (Thu)	3.868	7.940	6.352			
9/8/2017 (Fri)	3.090	7.466	5.984			
9/9/2017 (Sat)	3.071	8.372	5.978			
9/10/2017 (Sun)	2.906	7.847	5.847			
9/11/2017 (Mon)	2.964	7.725	5.936			
9/12/2017 (Tue)	2.936	7.711	5.913			
9/13/2017 (Wed)	**0.000**	**12.595**	3.535			

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Summary Flow Report

Site:
7
Hackensack Avenue Shopping Mall Bergen County, NJ 42" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			266.037			
Min:			0.000			
Avg:			6.046			
Max:			12.595			

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9.8 Meter Site No. 8

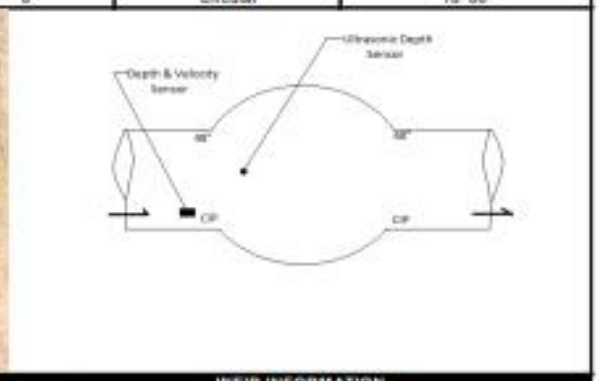
Flow metering was conducted on the Southern Trunk Sewer near the WPCF. (See Plate 8)

FLOW
ASSESSMENT SERVICES

METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	DATE: March 7, 2017	JOB#: 16095
LOCATION: 20 Empire Boulevard	MH#:	METER SITE: 8
GPS/COMMENTS: 40.831399, -74.042858		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	48	CIP	25	8	Circular	18' 06"
Incoming						
Incoming						
Outgoing	48	CIP	25	8	Circular	18' 06"



SURCHARGE INFORMATION		WEIR INFORMATION
SURCHARGE NONE EVIDENT:	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO: 15' 00"	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

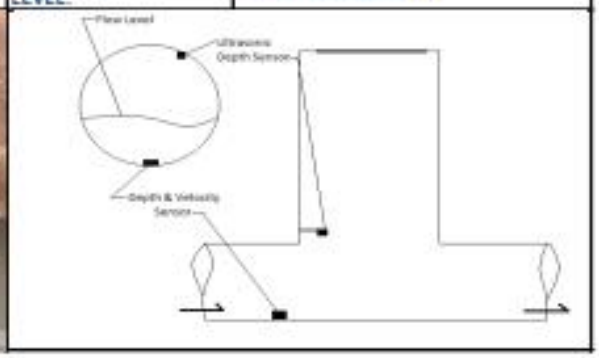


Plate 8

Table 9-9 Summary Flow Report Temp Meter Site 8

Summary Flow Report

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/7/2017 (Tue)	5.186	7.228	2.625			
3/8/2017 (Wed)	3.397	7.609	5.740			
3/9/2017 (Thu)	3.488	7.885	5.631			
3/10/2017 (Fri)	3.494	7.722	5.749			
3/11/2017 (Sat)	3.359	7.620	5.492			
3/12/2017 (Sun)	2.891	7.093	5.334			
3/13/2017 (Mon)	3.033	7.121	5.375			
3/14/2017 (Tue)	2.801	7.657	5.328			
3/15/2017 (Wed)	3.052	7.509	5.600			
3/16/2017 (Thu)	3.535	7.534	5.691			
3/17/2017 (Fri)	3.504	7.890	5.924			
3/18/2017 (Sat)	3.166	7.866	5.804			
3/19/2017 (Sun)	3.509	8.955	6.356			
3/20/2017 (Mon)	4.112	9.271	6.683			
3/21/2017 (Tue)	4.232	8.882	6.924			
3/22/2017 (Wed)	4.503	9.245	6.687			
3/23/2017 (Thu)	3.843	8.482	6.377			
3/24/2017 (Fri)	3.770	8.226	6.210			
3/25/2017 (Sat)	4.028	8.264	6.070			
3/26/2017 (Sun)	3.799	8.578	6.020			
3/27/2017 (Mon)	3.891	9.501	6.597			
3/28/2017 (Tue)	4.202	10.882	6.953			
3/29/2017 (Wed)	5.084	9.235	7.140			
3/30/2017 (Thu)	4.377	8.777	6.648			
3/31/2017 (Fri)	4.578	15.394	9.114			
		Total for period	152.071			
		Min:	2.801			
		Avg:	6.083			
		Max:	15.394			

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Summary Flow Report

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	6.537	12.652	9.594			
4/2/2017 (Sun)	5.663	10.040	8.037			
4/3/2017 (Mon)	5.157	9.617	7.740			
4/4/2017 (Tue)	5.924	14.557	**10.692**			
4/5/2017 (Wed)	5.286	10.670	8.742			
4/6/2017 (Thu)	6.161	**14.622**	9.531			
4/7/2017 (Fri)	7.604	11.262	9.346			
4/8/2017 (Sat)	5.344	10.768	8.284			
4/9/2017 (Sun)	5.217	9.657	7.642			
4/10/2017 (Mon)	5.058	9.944	7.721			
4/11/2017 (Tue)	4.930	9.839	7.594			
4/12/2017 (Wed)	5.016	9.307	7.288			
4/13/2017 (Thu)	4.459	8.829	7.006			
4/14/2017 (Fri)	4.785	8.608	6.819			
4/15/2017 (Sat)	4.169	8.624	6.548			
4/16/2017 (Sun)	4.124	8.948	6.390			
4/17/2017 (Mon)	4.096	8.699	6.583			
4/18/2017 (Tue)	3.810	8.471	6.391			
4/19/2017 (Wed)	4.034	8.520	6.325			
4/20/2017 (Thu)	4.045	8.713	6.456			
4/21/2017 (Fri)	4.407	8.780	6.836			
4/22/2017 (Sat)	3.839	8.447	6.126			
4/23/2017 (Sun)	3.749	8.127	6.088			
4/24/2017 (Mon)	**3.716**	8.568	6.304			
4/25/2017 (Tue)	3.866	11.312	8.959			
4/26/2017 (Wed)	4.748	9.569	7.538			
4/27/2017 (Thu)	4.584	9.057	6.993			
4/28/2017 (Fri)	4.410	8.735	6.885			
4/29/2017 (Sat)	4.305	8.678	6.534			
4/30/2017 (Sun)	3.723	8.050	6.091			
		Total for period	220.573			
		Min:	3.716			
		Avg:	7.352			
		Max:	14.622			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	3.890	8.069	6.295			
5/2/2017 (Tue)	4.022	8.632	6.377			
5/3/2017 (Wed)	3.904	7.849	6.117			
5/4/2017 (Thu)	3.800	8.595	6.118			
5/5/2017 (Fri)	**3.744**	**21.104**	**9.650**			
5/6/2017 (Sat)	5.877	13.190	9.262			
5/7/2017 (Sun)	5.946	11.696	8.722			
5/8/2017 (Mon)	5.090	10.045	8.056			
5/9/2017 (Tue)	5.171	9.518	7.671			
5/10/2017 (Wed)	4.782	9.150	7.356			
5/11/2017 (Thu)	4.584	9.145	7.009			
5/12/2017 (Fri)	4.603	9.147	7.023			
5/13/2017 (Sat)	4.474	13.917	8.686			
5/14/2017 (Sun)	6.164	12.236	9.194			
5/15/2017 (Mon)	5.382	9.978	8.048			
5/16/2017 (Tue)	5.025	9.852	7.619			
5/17/2017 (Wed)	5.106	9.529	7.417			
5/18/2017 (Thu)	4.822	9.176	7.371			
5/19/2017 (Fri)	4.789	9.963	7.112			
5/20/2017 (Sat)	4.293	8.480	6.426			
5/21/2017 (Sun)	4.277	8.286	6.358			
5/22/2017 (Mon)	4.095	9.257	7.097			
5/23/2017 (Tue)	4.421	9.346	6.972			
5/24/2017 (Wed)	4.431	8.806	6.736			
5/25/2017 (Thu)	4.358	11.026	7.586			
5/26/2017 (Fri)	5.489	10.485	7.748			
5/27/2017 (Sat)	4.398	9.895	6.530			
5/28/2017 (Sun)	4.289	8.137	6.191			
5/29/2017 (Mon)	3.966	8.414	6.209			
5/30/2017 (Tue)	4.077	8.494	6.500			
5/31/2017 (Wed)	4.009	8.643	6.657			
		Total for period	226.126			
		Min:	3.744			
		Avg:	7.294			
		Max:	21.104			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	4.385	8.560	6.678			
6/2/2017 (Fri)	4.111	8.401	6.419			
6/3/2017 (Sat)	3.804	8.468	6.195			
6/4/2017 (Sun)	3.593	8.155	6.026			
6/5/2017 (Mon)	3.657	8.854	6.335			
6/6/2017 (Tue)	3.637	8.155	6.161			
6/7/2017 (Wed)	3.415	8.008	6.107			
6/8/2017 (Thu)	3.775	8.270	6.149			
6/9/2017 (Fri)	3.782	8.180	6.074			
6/10/2017 (Sat)	3.529	7.498	5.742			
6/11/2017 (Sun)	3.432	7.227	5.622			
6/12/2017 (Mon)	3.669	7.897	5.837			
6/13/2017 (Tue)	3.719	7.724	5.931			
6/14/2017 (Wed)	3.902	7.855	5.942			
6/15/2017 (Thu)	3.667	8.238	5.767			
6/16/2017 (Fri)	3.709	7.561	5.746			
6/17/2017 (Sat)	3.455	9.567	5.952			
6/18/2017 (Sun)	3.489	7.265	5.507			
6/19/2017 (Mon)	**3.220**	10.170	6.302			
6/20/2017 (Tue)	3.909	8.237	6.181			
6/21/2017 (Wed)	3.446	7.873	5.876			
6/22/2017 (Thu)	3.329	8.009	5.838			
6/23/2017 (Fri)	3.543	7.943	5.870			
6/24/2017 (Sat)	4.363	**11.368**	**7.016**			
6/25/2017 (Sun)	3.837	7.716	5.754			
6/26/2017 (Mon)	3.594	7.824	5.853			
6/27/2017 (Tue)	3.424	7.953	5.932			
6/28/2017 (Wed)	3.498	7.754	5.823			
6/29/2017 (Thu)	3.673	7.820	5.942			
6/30/2017 (Fri)	3.547	7.419	5.683			
		Total for period	180.263			
		Min:	3.220			
		Avg:	6.009			
		Max:	11.368			

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Summary Flow Report

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	3.446	7.144	5.328			
7/2/2017 (Sun)	3.322	6.819	5.004			
7/3/2017 (Mon)	3.094	6.954	5.180			
7/4/2017 (Tue)	3.142	7.194	4.870			
7/5/2017 (Wed)	2.946	7.150	5.235			
7/6/2017 (Thu)	3.139	6.941	5.347			
7/7/2017 (Fri)	3.055	**14.335**	**8.712**			
7/8/2017 (Sat)	3.746	7.676	5.553			
7/9/2017 (Sun)	2.723	7.347	5.069			
7/10/2017 (Mon)	2.834	7.635	5.334			
7/11/2017 (Tue)	3.259	7.573	5.347			
7/12/2017 (Wed)	2.978	7.827	5.220			
7/13/2017 (Thu)	2.672	6.544	4.933			
7/14/2017 (Fri)	2.845	12.107	8.044			
7/15/2017 (Sat)	3.411	7.171	5.425			
7/16/2017 (Sun)	2.952	6.801	5.029			
7/17/2017 (Mon)	2.941	6.840	5.182			
7/18/2017 (Tue)	2.954	6.816	5.304			
7/19/2017 (Wed)	3.064	6.798	5.238			
7/20/2017 (Thu)	2.815	6.746	5.141			
7/21/2017 (Fri)	2.982	6.667	5.023			
7/22/2017 (Sat)	2.932	6.498	4.843			
7/23/2017 (Sun)	3.086	6.976	5.177			
7/24/2017 (Mon)	3.078	10.211	6.199			
7/25/2017 (Tue)	3.488	6.998	5.408			
7/26/2017 (Wed)	3.224	7.199	5.164			
7/27/2017 (Thu)	3.287	7.875	5.153			
7/28/2017 (Fri)	2.883	6.911	5.018			
7/29/2017 (Sat)	2.872	8.202	4.517			
7/30/2017 (Sun)	**2.567**	6.093	4.337			
7/31/2017 (Mon)	2.685	6.162	4.635			
		Total for period	161.969			
		Min:	2.567			
		Avg:	5.225			
		Max:	14.335			

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Summary Flow Report

Site:
8
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	2.699	7.932	4.882			
8/2/2017 (Wed)	2.733	9.801	**5.350**			
8/3/2017 (Thu)	2.621	6.695	4.823			
8/4/2017 (Fri)	2.467	6.335	4.594			
8/5/2017 (Sat)	2.228	6.013	3.912			
8/6/2017 (Sun)	1.971	5.286	3.559			
8/7/2017 (Mon)	2.051	8.254	4.760			
8/8/2017 (Tue)	2.333	6.278	4.371			
8/9/2017 (Wed)	2.129	6.583	4.715			
8/10/2017 (Thu)	2.512	7.219	4.940			
8/11/2017 (Fri)	2.463	6.319	4.733			
8/12/2017 (Sat)	2.978	7.246	4.894			
8/13/2017 (Sun)	2.562	6.235	4.250			
8/14/2017 (Mon)	2.183	6.629	4.492			
8/15/2017 (Tue)	2.322	6.343	4.630			
8/16/2017 (Wed)	2.538	5.776	4.328			
8/17/2017 (Thu)	2.151	5.847	4.126			
8/18/2017 (Fri)	2.070	**9.947**	4.145			
8/19/2017 (Sat)	2.340	4.930	3.462			
8/20/2017 (Sun)	2.103	5.704	3.626			
8/21/2017 (Mon)	2.190	6.024	3.932			
8/22/2017 (Tue)	2.076	5.689	3.834			
8/23/2017 (Wed)	2.468	6.587	4.573			
8/24/2017 (Thu)	2.601	6.317	4.558			
8/25/2017 (Fri)	2.373	6.736	4.417			
8/26/2017 (Sat)	1.964	5.888	4.131			
8/27/2017 (Sun)	2.072	6.154	3.933			
8/28/2017 (Mon)	**1.956**	5.666	4.052			
8/29/2017 (Tue)	2.324	6.263	4.196			
8/30/2017 (Wed)	2.227	5.904	4.154			
8/31/2017 (Thu)	2.058	5.937	4.136			
9/1/2017 (Fri)	2.004	5.572	3.793			
9/2/2017 (Sat)	2.144	5.619	3.443			
9/3/2017 (Sun)	2.355	7.450	4.359			
9/4/2017 (Mon)	2.430	6.713	4.360			
9/5/2017 (Tue)	2.518	7.298	4.852			
9/6/2017 (Wed)	2.187	7.037	4.968			
9/7/2017 (Thu)	2.703	6.689	5.178			
9/8/2017 (Fri)	2.605	6.260	4.694			
9/9/2017 (Sat)	2.334	6.159	4.409			
9/10/2017 (Sun)	2.193	6.752	4.442			
9/11/2017 (Mon)	2.304	6.415	4.710			
9/12/2017 (Tue)	2.418	6.235	4.625			
9/13/2017 (Wed)	2.116	6.323	4.439			
9/14/2017 (Thu)	2.596	2.596	0.009			

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Summary Flow Report

Site:
6
20 Empire Boulevard | Bergen County, NJ | 48" Circular Line

FLOW ASSESSMENT SERVICES

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			192.799			
Min:			1.956			
Avg:			4.284			
Max:			9.947			

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9.9 Meter Site No. 9

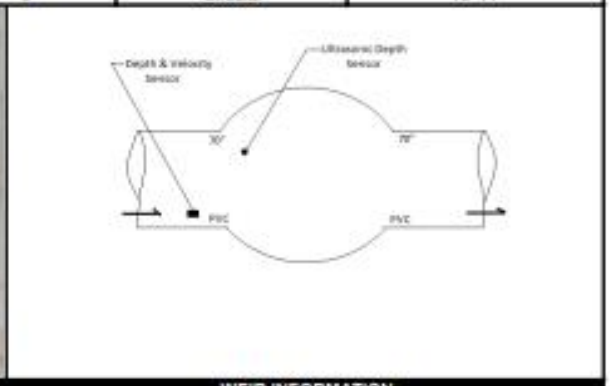
Water surface elevations were monitored in the Overpeck Creek Trunk Sewer in Leonia. The metering location was moved one manhole upstream due to access issues. (See Plate 9)

FLOW ASSESSMENT SERVICES

METER SITE INFORMATION FIELD LOG

PROJECT: Bergen County, NJ	DATE: March 8, 2017	JOB#: 16095
LOCATION: Overpeck County Park, South of Fort Lee Road	MH#:	METER SITE: 9
GPS/COMMENTS: 40.862028, -73.997113		

	Size (")	Material	Flow Depth (")	Debris	Shape	MH Depth
Incoming	70	PVC	27	0	Circular	16' 11"
Incoming						
Incoming						
Outgoing	70	PVC	27	0	Circular	16' 11"



SURCHARGE INFORMATION	WEIR INFORMATION	
SURCHARGE NONE EVIDENT: X	LENGTH:	HEIGHT ABOVE WEIR:
SURCHARGED MARKS TO:	BREADTH:	OVERFLOW OCCURS AT:
SURCHARGE CURRENTLY TO:	LEVEL:	

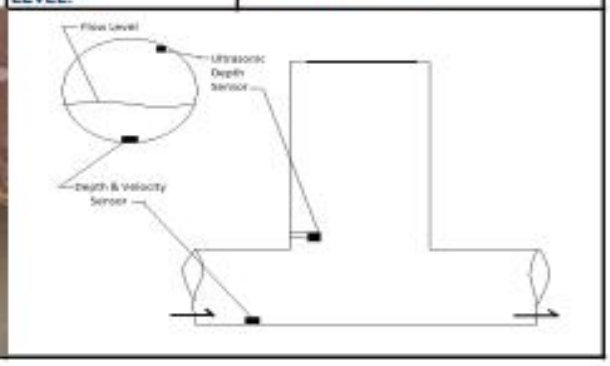


Plate 9

Table 9-10 Summary Flow Report Temp Meter 9

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
9
Overpeck County Park, South of Fort Lee RoadBergen County, NJ — 70° Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/8/2017 (Wed)	9.107	13.193	3.881			
3/9/2017 (Thu)	5.577	13.482	10.187			
3/10/2017 (Fri)	5.772	13.732	10.491			
3/11/2017 (Sat)	6.077	13.963	10.328			
3/12/2017 (Sun)	5.786	13.635	10.185			
3/13/2017 (Mon)	**5.173**	13.021	9.874			
3/14/2017 (Tue)	5.738	13.283	9.864			
3/15/2017 (Wed)	5.570	13.480	10.114			
3/16/2017 (Thu)	5.527	13.374	10.279			
3/17/2017 (Fri)	5.703	13.787	10.485			
3/18/2017 (Sat)	6.269	14.455	10.589			
3/19/2017 (Sun)	6.186	15.955	11.692			
3/20/2017 (Mon)	7.651	15.602	12.322			
3/21/2017 (Tue)	8.164	16.932	13.464			
3/22/2017 (Wed)	8.435	16.151	13.257			
3/23/2017 (Thu)	8.332	15.308	12.265			
3/24/2017 (Fri)	7.441	15.287	12.231			
3/25/2017 (Sat)	8.272	16.156	12.300			
3/26/2017 (Sun)	7.654	15.681	12.211			
3/27/2017 (Mon)	7.778	18.863	13.060			
3/28/2017 (Tue)	8.961	19.628	13.370			
3/29/2017 (Wed)	10.032	17.113	13.921			
3/30/2017 (Thu)	9.352	16.143	12.905			
3/31/2017 (Fri)	9.319	**26.765**	**17.193**			
		Total for period	276.479			
		Min:	5.173			
		Avg:	11.520			
		Max:	26.765			

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Summary Flow Report

Site:
9
Overpeck County Park, South of Fort Lee Road|Bergen County, NJ

70" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	15.199	22.915	18.485			
4/2/2017 (Sun)	10.911	18.777	15.341			
4/3/2017 (Mon)	9.958	17.715	14.391			
4/4/2017 (Tue)	11.990	**26.529**	**20.271**			
4/5/2017 (Wed)	12.154	19.991	16.550			
4/6/2017 (Thu)	11.119	25.325	17.842			
4/7/2017 (Fri)	12.687	21.254	17.426			
4/8/2017 (Sat)	12.270	18.670	15.469			
4/9/2017 (Sun)	9.875	17.932	14.571			
4/10/2017 (Mon)	9.786	16.919	13.554			
4/11/2017 (Tue)	8.854	16.757	13.473			
4/12/2017 (Wed)	9.078	15.583	12.557			
4/13/2017 (Thu)	8.417	16.261	12.758			
4/14/2017 (Fri)	7.945	15.678	12.491			
4/15/2017 (Sat)	8.469	15.323	12.251			
4/16/2017 (Sun)	7.840	16.292	12.159			
4/17/2017 (Mon)	7.545	14.779	11.874			
4/18/2017 (Tue)	6.944	14.990	11.502			
4/19/2017 (Wed)	7.045	14.954	11.495			
4/20/2017 (Thu)	7.311	15.016	11.485			
4/21/2017 (Fri)	7.958	15.641	11.843			
4/22/2017 (Sat)	7.360	14.265	11.089			
4/23/2017 (Sun)	**6.345**	14.952	10.984			
4/24/2017 (Mon)	6.468	13.921	10.915			
4/25/2017 (Tue)	6.608	16.934	12.008			
4/26/2017 (Wed)	8.979	17.461	13.522			
4/27/2017 (Thu)	9.114	14.618	12.381			
4/28/2017 (Fri)	8.541	14.193	11.953			
4/29/2017 (Sat)	8.033	13.954	11.539			
4/30/2017 (Sun)	7.671	13.573	11.301			
		Total for period	403.676			
		Min:	6.345			
		Avg:	13.456			
		Max:	26.529			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
9
Overpeck County Park, South of Fort Lee RoaBergen County, NJ

70° Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	7.449	13.270	11.262			
5/2/2017 (Tue)	7.438	13.480	11.182			
5/3/2017 (Wed)	7.098	13.207	10.824			
5/4/2017 (Thu)	6.786	13.493	10.473			
5/5/2017 (Fri)	**5.436**	**33.694**	15.486			
5/6/2017 (Sat)	12.493	21.629	16.339			
5/7/2017 (Sun)	10.141	17.288	14.191			
5/8/2017 (Mon)	9.650	17.215	13.522			
5/9/2017 (Tue)	8.008	16.692	12.763			
5/10/2017 (Wed)	8.527	15.608	12.095			
5/11/2017 (Thu)	7.354	15.831	11.815			
5/12/2017 (Fri)	7.181	15.703	11.705			
5/13/2017 (Sat)	7.467	24.729	14.751			
5/14/2017 (Sun)	12.712	22.191	**16.506**			
5/15/2017 (Mon)	10.310	17.696	14.207			
5/16/2017 (Tue)	9.014	16.729	13.283			
5/17/2017 (Wed)	8.164	15.896	12.452			
5/18/2017 (Thu)	7.456	16.318	12.271			
5/19/2017 (Fri)	8.024	15.418	11.869			
5/20/2017 (Sat)	7.292	14.280	10.977			
5/21/2017 (Sun)	7.505	14.883	11.178			
5/22/2017 (Mon)	7.068	15.374	11.960			
5/23/2017 (Tue)	7.438	15.025	11.556			
5/24/2017 (Wed)	6.403	15.425	11.282			
5/25/2017 (Thu)	5.928	16.359	11.986			
5/26/2017 (Fri)	9.826	15.937	13.021			
5/27/2017 (Sat)	7.851	15.073	11.264			
5/28/2017 (Sun)	6.988	14.103	10.922			
5/29/2017 (Mon)	7.625	14.370	11.131			
5/30/2017 (Tue)	7.344	14.420	11.280			
5/31/2017 (Wed)	7.132	15.428	11.212			
		Total for period	384.742			
		Min:	5.436			
		Avg:	12.411			
		Max:	33.694			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
9
Overpeck County Park, South of Fort Lee RoaBergen County, NJ

70" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	6.341	14.366	11.150			
6/2/2017 (Fri)	6.924	14.195	10.866			
6/3/2017 (Sat)	6.588	13.931	10.427			
6/4/2017 (Sun)	6.545	13.814	10.500			
6/5/2017 (Mon)	6.643	14.161	10.689			
6/6/2017 (Tue)	6.215	14.436	10.746			
6/7/2017 (Wed)	6.269	13.950	10.481			
6/8/2017 (Thu)	5.996	13.815	10.497			
6/9/2017 (Fri)	6.096	13.945	10.535			
6/10/2017 (Sat)	5.182	13.849	10.075			
6/11/2017 (Sun)	5.665	14.079	10.185			
6/12/2017 (Mon)	5.678	13.905	10.387			
6/13/2017 (Tue)	5.568	13.541	10.274			
6/14/2017 (Wed)	6.087	13.835	10.203			
6/15/2017 (Thu)	**4.937**	13.498	9.953			
6/16/2017 (Fri)	5.623	13.313	9.889			
6/17/2017 (Sat)	4.969	16.895	10.342			
6/18/2017 (Sun)	5.572	14.072	10.093			
6/19/2017 (Mon)	5.867	19.365	11.372			
6/20/2017 (Tue)	7.133	14.655	10.999			
6/21/2017 (Wed)	6.027	14.530	10.344			
6/22/2017 (Thu)	5.737	13.926	10.225			
6/23/2017 (Fri)	5.483	13.256	10.159			
6/24/2017 (Sat)	6.994	**20.987**	**12.427**			
6/25/2017 (Sun)	6.675	13.907	10.496			
6/26/2017 (Mon)	6.090	13.815	10.345			
6/27/2017 (Tue)	5.117	13.785	10.311			
6/28/2017 (Wed)	5.234	12.916	10.001			
6/29/2017 (Thu)	4.988	13.165	9.907			
6/30/2017 (Fri)	5.457	13.261	10.035			
		Total for period	313.915			
		Min:	4.937			
		Avg:	10.464			
		Max:	20.987			

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Summary Flow Report

Site:
9
Overpeck County Park, South of Fort Lee RoadBergen County, NJ

70" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	5.726	13.261	9.856			
7/2/2017 (Sun)	5.571	13.326	9.697			
7/3/2017 (Mon)	5.548	14.596	9.827			
7/4/2017 (Tue)	5.429	13.767	10.055			
7/5/2017 (Wed)	4.917	14.560	9.907			
7/6/2017 (Thu)	5.438	14.294	9.824			
7/7/2017 (Fri)	5.415	**21.132**	**11.571**			
7/8/2017 (Sat)	6.738	16.135	10.727			
7/9/2017 (Sun)	5.880	13.191	9.903			
7/10/2017 (Mon)	4.870	13.707	9.944			
7/11/2017 (Tue)	5.567	13.076	10.088			
7/12/2017 (Wed)	5.122	13.843	10.025			
7/13/2017 (Thu)	5.150	12.557	9.727			
7/14/2017 (Fri)	5.333	18.739	11.102			
7/15/2017 (Sat)	5.676	15.292	10.201			
7/16/2017 (Sun)	5.635	13.682	9.811			
7/17/2017 (Mon)	5.644	13.293	9.905			
7/18/2017 (Tue)	5.473	13.777	9.881			
7/19/2017 (Wed)	5.135	13.267	9.634			
7/20/2017 (Thu)	4.754	12.542	9.616			
7/21/2017 (Fri)	4.684	12.972	9.603			
7/22/2017 (Sat)	**4.474**	12.669	9.219			
7/23/2017 (Sun)	5.987	13.280	10.148			
7/24/2017 (Mon)	5.298	18.829	11.408			
7/25/2017 (Tue)	6.050	13.019	10.007			
7/26/2017 (Wed)	4.756	13.257	9.727			
7/27/2017 (Thu)	4.968	12.419	9.590			
7/28/2017 (Fri)	5.367	12.520	9.606			
7/29/2017 (Sat)	5.035	12.700	9.083			
7/30/2017 (Sun)	4.596	12.524	9.053			
7/31/2017 (Mon)	4.693	12.130	9.360			
		Total for period	308.113			
		Min:	4.474			
		Avg:	9.939			
		Max:	21.132			

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Summary Flow Report

Site:
9
Overpeck County Park, South of Fort Lee RoaBergen County, NJ

70" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	4.999	12.183	9.211			
8/2/2017 (Wed)	4.908	19.233	10.451			
8/3/2017 (Thu)	5.909	15.108	9.990			
8/4/2017 (Fri)	5.411	13.067	9.662			
8/5/2017 (Sat)	5.394	13.132	9.621			
8/6/2017 (Sun)	4.656	13.434	9.262			
8/7/2017 (Mon)	4.575	17.314	11.124			
8/8/2017 (Tue)	6.541	13.142	10.373			
8/9/2017 (Wed)	5.422	12.742	9.731			
8/10/2017 (Thu)	4.909	13.323	9.658			
8/11/2017 (Fri)	5.280	13.084	9.536			
8/12/2017 (Sat)	6.116	14.090	9.923			
8/13/2017 (Sun)	5.232	13.916	9.414			
8/14/2017 (Mon)	5.094	13.277	9.439			
8/15/2017 (Tue)	5.911	13.748	9.606			
8/16/2017 (Wed)	4.371	12.814	9.389			
8/17/2017 (Thu)	4.775	12.223	9.271			
8/18/2017 (Fri)	4.866	**27.323**	**12.310**			
8/19/2017 (Sat)	6.526	13.769	10.395			
8/20/2017 (Sun)	5.647	13.583	9.748			
8/21/2017 (Mon)	5.187	12.607	9.693			
8/22/2017 (Tue)	5.196	12.942	9.641			
8/23/2017 (Wed)	5.930	13.256	9.920			
8/24/2017 (Thu)	4.869	12.631	9.405			
8/25/2017 (Fri)	5.032	12.812	9.287			
8/26/2017 (Sat)	4.280	12.414	8.840			
8/27/2017 (Sun)	4.542	12.341	8.879			
8/28/2017 (Mon)	4.441	12.526	9.076			
8/29/2017 (Tue)	4.386	12.181	9.111			
8/30/2017 (Wed)	4.115	12.703	9.191			
8/31/2017 (Thu)	4.836	12.641	9.094			
9/1/2017 (Fri)	4.449	12.869	8.967			
9/2/2017 (Sat)	**4.102**	14.569	8.923			
9/3/2017 (Sun)	7.304	16.381	11.171			
9/4/2017 (Mon)	5.031	13.410	9.624			
9/5/2017 (Tue)	5.184	13.328	9.686			
9/6/2017 (Wed)	4.969	14.554	9.878			
9/7/2017 (Thu)	6.463	14.010	10.457			
9/8/2017 (Fri)	4.631	12.796	9.393			
9/9/2017 (Sat)	4.436	14.448	9.306			
9/10/2017 (Sun)	4.686	14.348	9.328			
9/11/2017 (Mon)	4.371	12.575	9.184			
9/12/2017 (Tue)	4.203	12.492	9.182			
9/13/2017 (Wed)	4.339	12.759	2.824			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
9
Overpeck County Park, South of Fort Lee RoaBergen County, NJ

70" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
Total for period			418.188			
Min:			4.102			
Avg:			9.504			
Max:			27.323			

9.10 Meter Site No. 10

Water surface elevations were monitored in the Overpeck Creek Relief Sewer in Leonia. (See Plate 10)

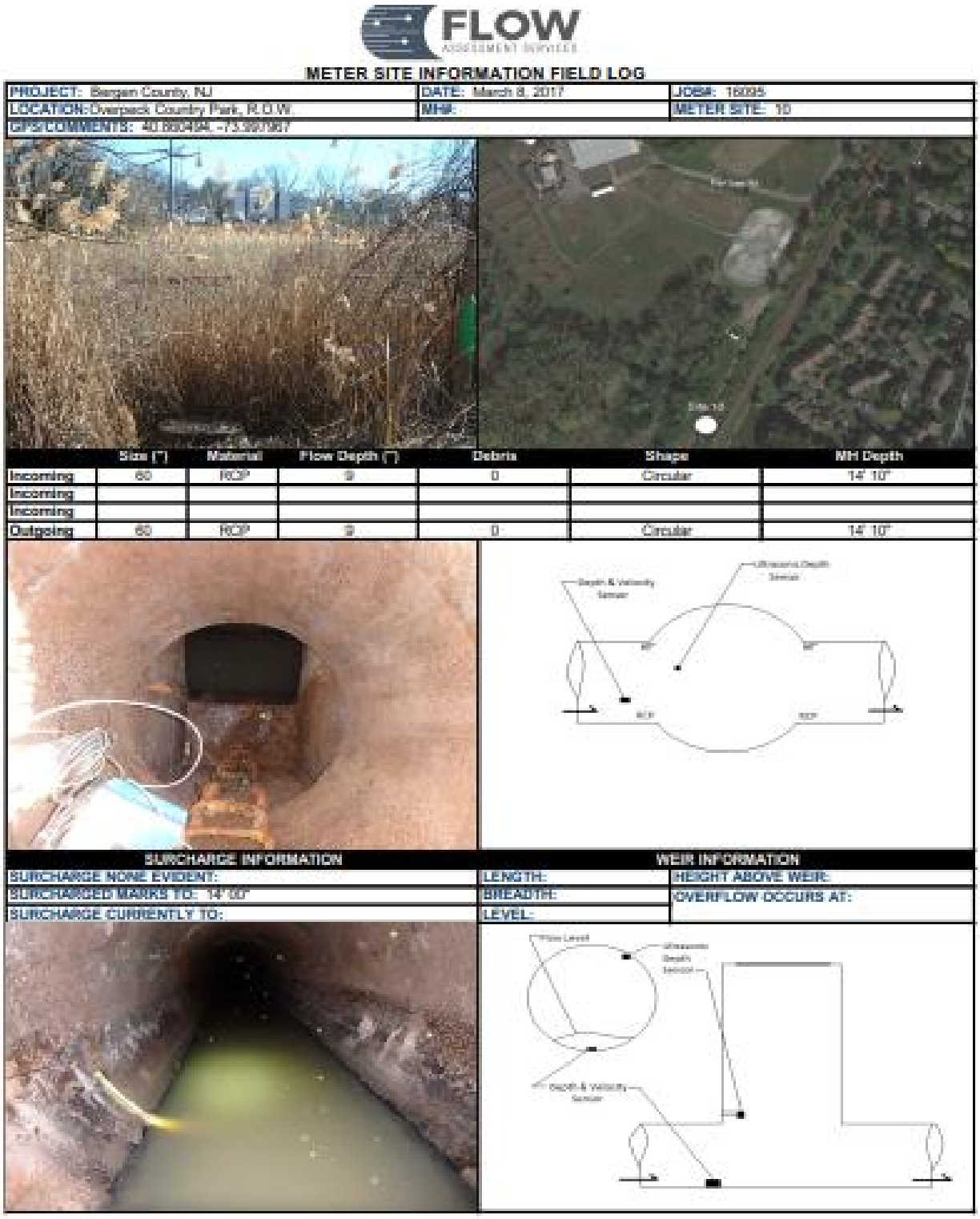

Plate 10

Table 9-11 Summary Flow Report Temp Meter Site 10

Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
3/8/2017 (Wed)	0.156	0.486	0.133			
3/9/2017 (Thu)	0.092	0.638	0.268			
3/10/2017 (Fri)	0.090	0.654	0.344			
3/11/2017 (Sat)	0.092	0.690	0.287			
3/12/2017 (Sun)	0.093	0.749	0.289			
3/13/2017 (Mon)	0.091	0.478	0.239			
3/14/2017 (Tue)	0.097	0.529	0.262			
3/15/2017 (Wed)	0.094	0.544	0.286			
3/16/2017 (Thu)	0.090	0.580	0.277			
3/17/2017 (Fri)	0.086	0.633	0.316			
3/18/2017 (Sat)	**0.085**	0.730	0.306			
3/19/2017 (Sun)	0.089	1.076	0.539			
3/20/2017 (Mon)	0.090	1.118	0.566			
3/21/2017 (Tue)	0.095	1.670	0.831			
3/22/2017 (Wed)	0.183	1.450	0.754			
3/23/2017 (Thu)	0.094	1.104	0.533			
3/24/2017 (Fri)	0.088	0.991	0.509			
3/25/2017 (Sat)	0.096	1.154	0.547			
3/26/2017 (Sun)	0.102	1.178	0.566			
3/27/2017 (Mon)	0.095	2.210	0.874			
3/28/2017 (Tue)	0.129	2.904	1.003			
3/29/2017 (Wed)	0.298	2.161	1.084			
3/30/2017 (Thu)	0.136	1.477	0.711			
3/31/2017 (Fri)	0.161	**6.796**	**2.508**			
		Total for period	14.031			
		Min:	0.085			
		Avg:	0.585			
		Max:	6.796			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
4/1/2017 (Sat)	1.802	5.005	3.057			
4/2/2017 (Sun)	0.803	2.816	1.710			
4/3/2017 (Mon)	0.311	2.234	1.274			
4/4/2017 (Tue)	0.509	**6.755**	**4.009**			
4/5/2017 (Wed)	1.225	3.391	2.309			
4/6/2017 (Thu)	0.513	6.548	2.805			
4/7/2017 (Fri)	1.596	3.832	2.672			
4/8/2017 (Sat)	0.831	2.856	1.744			
4/9/2017 (Sun)	0.349	2.471	1.399			
4/10/2017 (Mon)	0.273	2.068	1.249			
4/11/2017 (Tue)	0.234	1.695	1.020			
4/12/2017 (Wed)	0.192	1.520	0.898			
4/13/2017 (Thu)	0.155	1.405	0.743			
4/14/2017 (Fri)	0.133	1.436	0.672			
4/15/2017 (Sat)	0.124	1.389	0.635			
4/16/2017 (Sun)	0.124	1.440	0.654			
4/17/2017 (Mon)	0.113	1.057	0.549			
4/18/2017 (Tue)	0.100	0.956	0.469			
4/19/2017 (Wed)	0.092	0.953	0.451			
4/20/2017 (Thu)	0.093	1.319	0.457			
4/21/2017 (Fri)	0.109	1.615	0.546			
4/22/2017 (Sat)	0.091	0.850	0.395			
4/23/2017 (Sun)	0.090	0.881	0.397			
4/24/2017 (Mon)	**0.084**	0.773	0.373			
4/25/2017 (Tue)	0.086	2.893	0.698			
4/26/2017 (Wed)	0.182	2.015	0.909			
4/27/2017 (Thu)	0.111	1.323	0.628			
4/28/2017 (Fri)	0.097	1.144	0.514			
4/29/2017 (Sat)	0.094	1.061	0.462			
4/30/2017 (Sun)	0.088	0.942	0.432			
		Total for period	34.129			
		Min:	0.084			
		Avg:	1.138			
		Max:	6.755			

Summary Flow Report

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
5/1/2017 (Mon)	0.090	0.873	0.409			
5/2/2017 (Tue)	0.090	0.877	0.393			
5/3/2017 (Wed)	0.086	0.770	0.340			
5/4/2017 (Thu)	0.087	0.758	0.315			
5/5/2017 (Fri)	0.090	10.653	3.565			
5/6/2017 (Sat)	1.498	3.676	2.358			
5/7/2017 (Sun)	0.358	2.496	1.287			
5/8/2017 (Mon)	0.188	1.999	0.992			
5/9/2017 (Tue)	0.140	1.672	0.767			
5/10/2017 (Wed)	0.116	1.638	0.671			
5/11/2017 (Thu)	0.105	1.323	0.604			
5/12/2017 (Fri)	0.099	1.232	0.517			
5/13/2017 (Sat)	0.099	6.453	1.998			
5/14/2017 (Sun)	1.021	4.556	2.186			
5/15/2017 (Mon)	0.351	2.060	1.120			
5/16/2017 (Tue)	0.186	1.759	0.930			
5/17/2017 (Wed)	0.146	1.889	0.808			
5/18/2017 (Thu)	0.132	1.486	0.712			
5/19/2017 (Fri)	0.112	1.425	0.662			
5/20/2017 (Sat)	0.098	1.166	0.462			
5/21/2017 (Sun)	0.092	1.057	0.468			
5/22/2017 (Mon)	0.100	1.140	0.654			
5/23/2017 (Tue)	0.095	1.200	0.527			
5/24/2017 (Wed)	0.095	1.075	0.478			
5/25/2017 (Thu)	0.094	1.783	0.738			
5/26/2017 (Fri)	0.261	1.854	0.900			
5/27/2017 (Sat)	0.092	1.110	0.451			
5/28/2017 (Sun)	0.092	0.946	0.368			
5/29/2017 (Mon)	0.092	0.931	0.409			
5/30/2017 (Tue)	0.090	0.869	0.396			
5/31/2017 (Wed)	0.092	0.838	0.394			
		Total for period	26.860			
		Min:	0.086			
		Avg:	0.867			
		Max:	10.653			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
6/1/2017 (Thu)	0.095	0.884	0.360			
6/2/2017 (Fri)	0.089	0.702	0.315			
6/3/2017 (Sat)	0.087	0.752	0.270			
6/4/2017 (Sun)	0.085	0.616	0.284			
6/5/2017 (Mon)	0.090	0.661	0.298			
6/6/2017 (Tue)	0.089	0.738	0.303			
6/7/2017 (Wed)	0.090	0.764	0.274			
6/8/2017 (Thu)	0.091	0.626	0.258			
6/9/2017 (Fri)	0.088	0.663	0.261			
6/10/2017 (Sat)	0.085	0.554	0.219			
6/11/2017 (Sun)	0.087	0.535	0.236			
6/12/2017 (Mon)	0.086	0.548	0.235			
6/13/2017 (Tue)	0.086	0.498	0.220			
6/14/2017 (Wed)	0.090	0.520	0.213			
6/15/2017 (Thu)	0.082	0.546	0.205			
6/16/2017 (Fri)	0.083	0.454	0.205			
6/17/2017 (Sat)	0.086	1.390	0.307			
6/18/2017 (Sun)	0.079	0.568	0.229			
6/19/2017 (Mon)	0.077	2.042	0.500			
6/20/2017 (Tue)	0.078	0.738	0.270			
6/21/2017 (Wed)	**0.073**	0.550	0.223			
6/22/2017 (Thu)	0.076	0.487	0.196			
6/23/2017 (Fri)	0.074	0.440	0.189			
6/24/2017 (Sat)	0.082	**3.099**	**0.690**			
6/25/2017 (Sun)	0.074	0.585	0.224			
6/26/2017 (Mon)	0.074	0.468	0.203			
6/27/2017 (Tue)	0.079	0.565	0.207			
6/28/2017 (Wed)	0.074	0.463	0.182			
6/29/2017 (Thu)	0.078	0.398	0.173			
6/30/2017 (Fri)	0.087	0.393	0.180			
		Total for period	7.928			
		Min:	0.073			
		Avg:	0.264			
		Max:	3.099			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
7/1/2017 (Sat)	0.074	0.527	0.172			
7/2/2017 (Sun)	0.063	0.389	0.149			
7/3/2017 (Mon)	0.066	0.573	0.148			
7/4/2017 (Tue)	0.067	0.560	0.182			
7/5/2017 (Wed)	0.075	0.380	0.159			
7/6/2017 (Thu)	0.070	0.316	0.145			
7/7/2017 (Fri)	0.076	3.351	0.586			
7/8/2017 (Sat)	0.071	0.665	0.218			
7/9/2017 (Sun)	0.070	0.418	0.171			
7/10/2017 (Mon)	0.075	0.391	0.164			
7/11/2017 (Tue)	0.069	0.333	0.157			
7/12/2017 (Wed)	0.069	0.352	0.152			
7/13/2017 (Thu)	0.068	0.359	0.153			
7/14/2017 (Fri)	0.071	2.136	0.433			
7/15/2017 (Sat)	0.072	0.463	0.177			
7/16/2017 (Sun)	0.071	0.351	0.163			
7/17/2017 (Mon)	0.071	0.330	0.160			
7/18/2017 (Tue)	0.075	0.341	0.155			
7/19/2017 (Wed)	0.075	0.313	0.150			
7/20/2017 (Thu)	0.061	0.287	0.142			
7/21/2017 (Fri)	0.030	0.332	0.139			
7/22/2017 (Sat)	0.046	0.360	0.123			
7/23/2017 (Sun)	0.062	0.427	0.170			
7/24/2017 (Mon)	0.077	2.164	0.484			
7/25/2017 (Tue)	0.077	0.387	0.178			
7/26/2017 (Wed)	0.075	0.328	0.154			
7/27/2017 (Thu)	0.074	0.276	0.141			
7/28/2017 (Fri)	0.025	0.328	0.148			
7/29/2017 (Sat)	0.040	0.276	0.124			
7/30/2017 (Sun)	0.045	0.270	0.133			
7/31/2017 (Mon)	0.041	0.231	0.137			
		Total for period	5.867			
		Min:	0.025			
		Avg:	0.189			
		Max:	3.351			

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Summary Flow Report

FLOW ASSESSMENT SERVICES

Site:
10
Overpeck County Park, R.O.W. Bergen County, NJ 60" Circular Line

Date	Minimum Flow (mgd)	Peak Flow (mgd)	Total Daily Flow (mg)	Total Rain (in)	Peak Hourly Rain (in)	Peak Interval Rain (in)
8/1/2017 (Tue)	0.048	0.212	0.124			
8/2/2017 (Wed)	0.063	2.468	0.396			
8/3/2017 (Thu)	0.071	0.408	0.172			
8/4/2017 (Fri)	0.071	0.365	0.151			
8/5/2017 (Sat)	0.071	0.383	0.151			
8/6/2017 (Sun)	0.056	0.336	0.128			
8/7/2017 (Mon)	0.040	1.374	0.435			
8/8/2017 (Tue)	0.075	0.419	0.188			
8/9/2017 (Wed)	0.074	0.324	0.151			
8/10/2017 (Thu)	0.073	0.268	0.140			
8/11/2017 (Fri)	**0.022**	0.261	0.131			
8/12/2017 (Sat)	0.063	0.368	0.139			
8/13/2017 (Sun)	0.041	0.274	0.132			
8/14/2017 (Mon)	0.043	0.296	0.134			
8/15/2017 (Tue)	0.028	0.262	0.128			
8/16/2017 (Wed)	0.041	0.274	0.133			
8/17/2017 (Thu)	0.043	0.248	0.122			
8/18/2017 (Fri)	0.037	**6.351**	**1.004**			
8/19/2017 (Sat)	0.070	0.632	0.199			
8/20/2017 (Sun)	0.070	0.376	0.154			
8/21/2017 (Mon)	0.070	0.282	0.148			
8/22/2017 (Tue)	0.058	0.286	0.143			
8/23/2017 (Wed)	0.037	0.306	0.141			
8/24/2017 (Thu)	0.048	0.283	0.128			
8/25/2017 (Fri)	0.049	0.268	0.126			
8/26/2017 (Sat)	0.053	0.266	0.120			
8/27/2017 (Sun)	0.043	0.231	0.120			
8/28/2017 (Mon)	0.040	0.218	0.118			
8/29/2017 (Tue)	0.036	0.197	0.120			
8/30/2017 (Wed)	0.030	0.269	0.126			
8/31/2017 (Thu)	0.045	0.263	0.120			
9/1/2017 (Fri)	0.038	0.226	0.120			
9/2/2017 (Sat)	0.032	0.622	0.148			
9/3/2017 (Sun)	0.054	1.326	0.332			
9/4/2017 (Mon)	0.072	0.467	0.169			
9/5/2017 (Tue)	0.070	0.359	0.155			
9/6/2017 (Wed)	0.055	0.642	0.181			
9/7/2017 (Thu)	0.073	0.547	0.195			
9/8/2017 (Fri)	0.071	0.369	0.137			
9/9/2017 (Sat)	0.051	0.347	0.129			
9/10/2017 (Sun)	0.027	0.340	0.140			
9/11/2017 (Mon)	0.036	0.247	0.126			
9/12/2017 (Tue)	0.035	0.280	0.127			
9/13/2017 (Wed)	0.078	0.264	0.054			

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10 CSO Sewer System Characterization Reports

The goal of the Sewer System Characterization is to develop a district wide (regional) mathematical computer model of the existing wastewater flows entering the BCUA Truck Sewer System that could then be utilized as a predictive tool to assess potential impacts from CSO Controls being proposed under the Long-Term Control Plan. The BCUA model was built around the BCUA Trunk Sewers and used point of connection flow meters where separate sewered municipalities contribute their flow to the BCUA trunk. In addition to the simulation of wastewater flows from the forty-four separated sewered communities, a more detailed modeling effort is required for the tributary communities with combined sewer systems (Fort Lee, Hackensack, & Ridgefield Park).

All three municipalities have undertaken sewer system characterization studies on their individual sewer systems, and have developed their calibrated and verified collection system computer models. Models for the City of Hackensack and the Village of Ridgefield Park have been shared with the BCUA. These models have been incorporated fully into the BCUA model and then reviewed and checked against the flows as predicted during their individual calibration and/or verification to assure that the imported model was consistent with the original, and realistically depict the timing, volume, and distribution of flows added to BCUA's Trunk Sewers. At the time of this report the model for the Borough of Fort Lee is still undergoing finalization. Once completed the Fort Lee model shall also be incorporated into the BCUA model and checked and verified for consistency with the original.

Additional details on the CSO Sewer System Characterization Studies undertaken by each municipality can be found in the individual municipal reports as follows:

- Borough of Fort Lee Sewer System Characterization Report
- City of Hackensack Sewer System Characterization Report
- Village of Ridgefield Park Sewer System Characterization Report

Electronic copies of each report shall be forwarded by each member to each member for reference. Electronic copies of individual reports will only be provided by individual members to assure that the report as provided is up to date and consistent with current work.

Mott MacDonald